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The AUTOMOBILE

Vol. XXXV
No. 12

NEW YORK, SEPTEMBER 21, 1916

Ten cents a copy
Three dollars a year

Maud L'Anphere Crook

Each nationality has its admirable characteristics. They fuse and blend in America's great melting pot, and there emerges a new national type combining the excellences of all—the American.

Motors are made in many lands, with characteristic features of design. France, England, Germany, Italy, America—each contributes, through its notable engineers, to the world's motor experience. By means of its customer-connections with over 150 manufacturers of automobiles and trucks in both Europe and America, the Continental Motors Company maintains unbroken communication with every reliable source of motor experience in the world.

Into the Continental crucible pours all this wealth of engineering achievement. Purged of dross, freed from all freakishness, refined and perfected by its own superb corps of engineering experts, there emerges that new type combining in standardized form the excellences of all — the world-famous Continental Motor.

CONTINENTAL MOTORS COMPANY

OFFICES:
Detroit, Michigan

FACTORIES:
Detroit, Muskegon

Largest exclusive motor manufacturers in the world.

Continental Motors

The Value and Cost of Our Speedometer Service

Our chain of direct factory branches and service stations which covers the country plus our large field organization of service men costs us more per speedometer than any reduction any other speedometer manufacturer might offer you.

And our additional overhead serves you—not us.

As 95% of the automobile manufacturers willingly pay the difference we must be on the right track.

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

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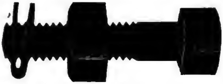
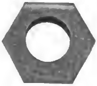
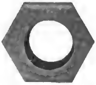


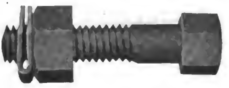
Spring Nut Lock, loose, applied on bolt before being set in place to hold until taken off



Front view



Rear View



Spring Nut Lock tightened against Nut. Prevents shaking off—follows nut tightening against material

Will Firmly Lock All Nuts in Place on the Cars or Parts You Manufacture

SPRING NUT LOCKS

save the *countless* losses that are constantly occurring wherever machines are run and part is fastened to part by nuts and bolts

Better Be Safe Than Sorry

Whether you manufacture or sell any part of an automobile from the radiator to the rear axle *see to it* that every nut is ***safely***, **SECURELY, PERMANENTLY** locked in place on its bolt with a *Spring Nut Lock*

Increase the ***reliability***, DURABILITY, **STABILITY** of your motor, tractor battery or what not by slipping on over *every* nut that engages a thread this simple, light, cheap and positively *efficient* device that holds any nut permanently in place and yet may be released at will—when lock, nut and bolt are as good as ever and can be used over again as often as desired.

You cannot afford to be without *Spring Nut Locks.* You cannot afford the loss of prestige, the mental worry, the risk of serious losses in life, limb and pocket-book that are liable to occur *at any moment* where vibration can start nuts loosening that are not properly locked in place, but are yet expected to hold vital parts. *The Spring Nut Lock is your safety insurance.*

In anticipation of the great volume of advance orders that have already begun to pour in on us as the merits of this great little device is becoming known to the mechanical world, we have let contracts for the manufacture of *Spring Nut Locks* to The Stowell Company of South Milwaukee, Wis., who have one of the largest plants in the country adapted to turning out this safety necessity in the enormous quantities it will be needed.

The Lock slips on the bolt like a washer and as easily *—economy of time in application.*

Its cost to the user is a mere trifle more than a washer *—the initial economy.*

It will not cut the thread of the bolt—*enduring economy.*

Its cost will be little more than that of the simple washer, cheapest of all devices.

Price lists will be issued soon. Write us for your probable needs NOW. Get in line to get *your share of this first output.* Send us your name and business and get our *first price lists* when issued.

Spring Nut Locks for Standard Threads for the following sizes are scheduled for delivery on or before October 1st ⅜ in., ½ in., ⅝ in., ¾ in., ⅞ in. and 1 in. By November 1st we will try to supply all standard and special sizes and by January 1st we are in hopes to be able to fill all orders promptly, however large. In the meantime look out for your own needs by getting in touch with us immediately. Allotments will be made from first output in proportion to the size of the advance filled with us. Orders filled in rotation as received

Spring Nut Locks for S. A. E. Standard Thread for automobile use have been thoroughly tested out and have aroused the enthusiasm of automobile men wherever tried. Locks for S. A. E. Standard Threads for 5/16 in., ⅜ in., 7/16 in., ½ in. and 9/16 in. are also in preparation and will be ready about the same time. Get in your orders at once.

Jobbers, Dealers, Garage Men—all Dealers—should take steps to supply the early demand of their customers for Spring Nut Locks. **Manufacturers** who take pride in their product should be prepared to adopt them. Railroads where economy and safety are first must have them. Write us your needs today and let us help you.

SPRING NUT LOCK COMPANY

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Oilzum

Resists the Heat, Remains and Lubricates Longer and Better, Increases Power, Induces Smooth, Quiet Running, Reduces Oil Consumption, Prevents Smoke and Minimizes Carbon Troubles

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The AUTOMOBILE
THE CLASS JOURNAL COMPANY
231—241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, SEPTEMBER 21, 1916 No. 12

Important Trade News of the Week 469-471

Accessories in South America—Part V 472

Tractor Drives Knotty Problem 474

Temperature Control Will Be Elaborate 478

Truck and Tractor Engines—Part III 480

Aluminum Alloy Pistons in Singer 483

New Glide Roomier and More Powerful 486

Yale Eight in Production 488

Burford Truck in 2 and 4-Ton Models 489

Colorado to Have 45,000 Cars 490

Peru 2600-lb. Axle with Malleable Housing 491

Owen-Magnetic Cars on 5-Day Tour 492

Liberty Production on Quantity Basis 494

15.4 Per cent of N. Y., N. J. and Pa. Roads are Bituminous 494

Progressive Assembly System Speeds Up Liberty Production 495

The Rostrum 496
- Naphthalene Not Recommended in Fuel
- Why Four-Cylinder Pistons are Larger
- Compression Bad on Three Cylinders
- Information on Stearns-Knight Engine
- Believes in Full Elliptic Springs
- Redesigning Michigan Radiator

Accessories 498

Editorials 500

Trade News—Continued 501-510
- Including
  - Factory Miscellany
  - The Automobile Calendar
  - The Week in the Industry

Index to Advertisers 48-49

In the speed bearing world, "NORMA" stands for dependability. Therefore—when you adopt "NORMA"-equipped ignition, lighting and starting apparatus—you will introduce in your equipment an element of dependability which will add to the saleability and service quality of your car. The records of hundreds of thousands of "NORMA" Bearings in hundreds of thousands of cars, prove this.

"NORMA"
BALL BEARINGS
PATENTED

The NORMA COMPANY of AMERICA
1790 Broadway, New York City

This one in Virginia is good

And now comes good old staid Virginia with a Studebaker "Opportunity" that some enterprising dealer is going to snap up and develop into one of the richest markets in the South for the sale of the Studebaker cars.

This "Opportunity" is in a city that lies about a mile southwest of Norfolk, on the Elizabeth River. The last census figures place the total of population at 37,000 though there are very likely more than 40,000 people living there now.

The manufacture of paper, cotton, hosiery and knit goods are the leading industries. Shipyards and railway shops add materially to the industrial activity while an excellent harbour and rail transportation facilities furnished by 5 big railroads give impetus to a prosperous export business in cotton, lumber, naval stores and pig-iron.

Something more than financial strength and a signed agreement are necessary to secure this opportunity. You know the Studebaker requirements—Initiative, selling ability, and progress. **If you believe you have it in you to measure up—write for the facts.**

STUDEBAKER

Detroit, Mich.
South Bend, Ind. Walkerville, Ont.
Address all correspondence to Detroit

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, SEPTEMBER 21, 1916—CHICAGO NO. 12

48,750 Studebakers in 8 Months

1710 More Than in Whole Year of 1915—Output Increasing

DETROIT, MICH., Sept. 16—The Studebaker Corp., for the first eight months of 1916, ending Aug. 31, has sold more cars than for the entire 1915 year. In number of cars, 48,750 Studebakers were sold from Jan. 1 to Aug. 31 of this year, as compared with 47,040 for the whole of last year, a gain of 1710.

At the present rate, 1916 sales will be 55.4 per cent greater than 1915, or about 73,125 cars, meaning an aggregate gain for 1916 over the previous year of 26,085 cars, if the present rate is maintained. As a matter of fact, however, it is practically certain that the balance in favor of 1916 over 1915 will be greater than the estimate just given, for the output is being steadily increased, and the factory reports sales for the last four months of this year in larger proportion than for the whole eight months of this year.

100,000 Cars Planned

It is believed that Studebaker will sell about 80,000 cars, and, with recently authorized factory extensions, including additional buildings and equipment, will enable the production of 100,000 cars, that being the mark set for 1917.

Monteith F. & H. Manager

COLUMBUS, OHIO, Sept. 16—John C. Monteith has been named general manager of the Phelps Mfg. Co., this city, maker of the F. & H. wire wheel.

Bill and Decou Resign from Nash Motors Co.

KENOSHA, WIS., Sept. 16—Louis H. Bill of the Nash Motors Co., formerly the Thos. B. Jeffery Co., this city, has resigned as general manager, effective Oct. 1. He expects to return to his home in San Francisco. Jerry Decou, who has been general factory manager, resigned Sept. 15 and is succeeded by John Bjorn, formerly superintendent. Mr. Bill's successor has not been announced. Bill is one of the old men in the trade having been branch manager of the H. A. Lozier Co. in the bicycle trade, becoming branch manager of the Jeffery company in 1905 and entering the factory in 1913.

Friend Returns to Mitchell as President

RACINE, WIS., Sept. 20—*Special Telegram*—Otis C. Friend has returned to the Mitchell Motor Co., Inc., as president and general manager, succeeding H. L. McLaren, who resigned 2 months ago. John W. Bate is vice-president and chief engineer.

Mr. Friend left the Mitchell company to become vice-president and general manager of the United Motors Corp., but assumes his new duties with the Mitchell company at once.

Other Officers

W. H. Armstrong is secretary and treasurer and F. L. Mitchell, formerly treasurer, becomes comptroller. Mr. McLaren remains president of the Racine Tire Co.

Mr. Friend has been connected with the automobile industry for nearly a score of years beginning with the Chicago sales of the Locomobile. He joined the sales force of the Chicago Mitchell agency in 1900 and later handled Mitchells as the firm of Brown & Friend of Milwaukee. Mr. Friend then became purchasing agent of the Mitchell-Lewis factory and was successively assistant to J. W. Bate and general superintendent of shops. On Aug. 1 announcement was made that he had resigned as sales manager of the Mitchell-Lewis company to become vice-president of the United Motors Corp.

Saxon Stock Placed on 7% Basis

Fiscal Year Profits $1,316,272—Output 25,500 Cars, 15,651 Gain

NEW YORK CITY, Sept. 20—The dividend of the Saxon Motor Car Corp. has been increased from 6 to 7 per cent. This is put into effect by the declaration of a quarterly payment of 1¾ per cent, payable Oct. 2. Net profits for the year ending June 30 were reported as $1,316,272, or approximately $116,000 greater than the estimates made in official circles during the last quarter of the company's fiscal year, and equivalent to nearly $22 a share on the $6,000,000 stock. The first dividend was paid last July.

The output of the company during the fiscal year was 25,500 cars, an increase of 15,651 over the preceding year when 9843 cars were built.

President Harry W. Ford, in his annual statement to stockholders, reports that the company has on file contracts with dealers for 50,000 cars, with a number of territories still to be closed.

SAXON BALANCE SHEET—JUNE 30, 1916

Assets		
Plant and equipment		$73,914.18
Investments		7,500.00
Current Assets (Inc. Inventories)		
Cash	$596,722.14	
Notes and accounts receivable	392,830.17	
Inventories of materials and cars on hand	2,134,326.94	
		3,123,879.25
Deferred charges		18,142.57
Good will, models and pat. rights		4,557,229.08
		$7,780,665.08
Liabilities		
Capital stock		$6,000,000.00
Notes and accounts payable, etc.		907,222.38
Surplus:		
Being the profits earned for the eight months from Nov. 1st, 1915	$963,442.70	
Less: Dividend paid June 30, 1916	90,000.00	
		873,442.70
		$7,780,665.08

Hudson Coast-to-Coast Record

Super-Six Covers 3476 Miles in 5 Days, 3 Hours and 31 Min.

TRANSCONTINENTAL RECORDS

Car	Driver	Time			Date
		Days	Hrs.	Min.	
Hudson	Paterson Mulford Vincent	5	3	31	Sept., 1916
Marmon	Stevens	5	18	30	July, 1916
Cadillac	Baker	7	11	52	May, 1916
Stutz	Baker	11	7	15	May, 1915

NEW YORK CITY, Sept. 19—The transcontinental record has been lowered 14 hr. 59 min. by a Hudson Super-six. The speed from San Francisco to New York averaged 27.14 m.p.h. and the distance was 3476 miles. The Hudson car reached New York 5 days, 3 hr. and 31 min. after leaving San Francisco. The best railroad time across the continent is 3 days, 21 hr. 45 min., according to railroad officials here.

Left Wednesday, Sept. 13

The car left San Francisco with A. H. Patterson of Stockton, Cal., at the wheel at 12.01 a. m. Wednesday, Sept. 13. It arrived at Columbus Circle the following Monday at 6.31 a. m. Patterson drove to Elko, Nev., Mulford took the wheel there and drove to Laramie, Wyo. Patterson again took the wheel and brought the car to South Bend, Ind. C. H. Vincent drove the last lap of 910 miles into New York. With these men in the car were W. Sturm and L. Kalinsky.

No Tire Trouble

The trip was made on United States Royal Cord tires and came through without trouble.

Following is the check of Hudson Transcontinental car:

Left San Francisco, Sept. 13, 12.01 a. m., checked by L. J. Pinkson, automobile editor San Francisco *Chronicle* and W. C. Kieffer, general agent Wells Fargo & Co.

Carson City, Sept. 13, 7.25 a. m., 253 miles, A. C. Cunningham, blacksmith.

Ogden, Nev., Sept. 14, 10.05 a. m., 842 miles, W. W. Fleetwood, clergyman and F. W. Wheeby, dentist.

Laramie, Wyo., Sept. 15, 5.39 a. m., 1395 miles, G. T. Glessner, dentist and E. W. Johnson, undertaker.

North Platt, Neb., Sept. 15, 2.45 p. m., 1560 miles, J. L. Souder and L. A. Spencer.

Omaha, Neb., Sept. 16, 2.05 a. m., 1844 miles, A. P. Ginon, lumber dealer.

Des Moines, Iowa, Sept. 16, 10.36 a. m., 2029 miles, Dr. D. Lecon, automobile editor *Register*, and H. E. Ward, newspaperman.

Joliet, Ill., Sept. 16, 8.25 p. m., 2381 miles, G. S. Jackson, manager Baskiel Motor Co.

South Bend, Ind., Sept. 16, 12 midnight, 2491 miles, J. F. Cole, president National Co.

Buffalo, N. Y., Sept. 17, 2.30 p. m., 2971 miles, H. M. Wall, president New York State Motor Federation.

New York, Sept. 18, 6.31 a. m., James Hemstreet, American Automobile Assn.

Signal-Commerce Truck Merger Abandoned

DETROIT, MICH., Sept. 19—The merging of the Signal Motor Truck Co. and the Commerce Motor Truck Co. here under the name of Signal-Commerce Motor Truck Co. has been abandoned. It had been the plan to take over the two properties and incorporate under New York State laws with a capital stock of $600,000, shares of no par value.

Thomas Neal, president of the Signal concern and at one time head of the General Motors Co., was to have been president of the merger and W. E. Parker, president of the Commerce company was to have been vice-president of the proposition.

The two motor truck manufacturing concerns involved in the negotiations will revert to their original individual identities and each will continue to operate separately as heretofore.

Ruse, Production Expert, Dies

KENOSHA, WIS., Sept. 16—John W. Ruse, one of the best known production experts in the automobile industry, died here yesterday of acute dilation of the heart after a brief illness. Mr. Ruse was for 8 years identified with the Buick Motors Co. at Flint, Mich., for the last 6 years as general superintendent. Several weeks ago he came here to become associated with C. W. Nash, president of the Nash Motors Co.

To Vote Fisk Capital Increase

Meeting Oct. 2, To Decide on Increase of $12,500,000 or Less

BOSTON, MASS., Sept. 18—Stockholders of the Fisk Rubber Co., will vote at a meeting on Oct. 2, on an increase of capital stock of $12,500,000. Of the new capital, $7,500,000 or less is to be first preferred, and $500,000 or less is to be second preferred.

The stockholders also will vote on authorizing an increase in the common stock by an amount necessary to take care of conversions of existing second preferred and proposed first and second preferred. A proposition to reduce the authorized capital of the company by $5,000,000, the amount of second preferred stock, series B, authorized a few months ago, but not issued, will be submitted.

First Preferred Convertible

The new first preferred stock, if authorized, may be converted into common stock prior to Jan. 1, 1922 at 125, four shares of common for five preferred, and from Jan. 1, 1922, to Dec. 31, 1926, at $150, four shares of common for six preferred. There is $2,000,000 second preferred stock now convertible into common up to Nov. 1, 1917, and the stockholders will be asked to approve an extension of this period until Nov. 1, 1923.

Holders of the present first preferred stock will be offered pro rata $5,000,000 of the new first convertible preferred at par and accrued dividends, while holders of the present second preferred and common stocks will be offered pro rata $2,500,000 of the new second preferred stock at par and accrued dividends.

Ralph Mulford at the wheel of the Hudson Super-six which established a new transcontinental record by traversing the 3476 miles from San Francisco to New York in 5 days, 3 hr. and 31 min.

S. A. E. Standards Men Meet

Straight Side Tires a Standards Possibility—Electric Units Mounting Problems

DETROIT, MICH., Sept. 18—Two meetings of S. A. E. standards committees were held last week. The newly formed tire and rim standards met for the first time and discussed matters relating to pneumatic and solid tires. It was agreed that there are strong probabilities that straight side tires can be made standard for the bulk of the sizes in use, though it is thought the clincher is better for the smallest diameters. There is still some debate as to whether or not the largest sizes in use can be made as satisfactorily in straight side as in clincher. The question will be discussed at the October meeting of the standards committee, which will be held in Washington probably about Oct. 18.

It was reported that the rim situation is improving and that a standard felloe band for passenger car wheels will soon be a practical possibility.

The other meeting was of the subcommittee on the standardization of starting motor and generator mountings. This committee has found its apparently simple task to be extremely complicated, and the members have some of them done a great deal of drafting room work in trying out existing engine drawings against standard mountings. Still more of this work will have to be done before a decision can be reached, but the members are giving so much time to the matter that a report is hoped for at the January meeting of the society. The main trouble is found in starting motor mountings, for the space available is usually much more limited than for the generator. It seems, however, certain that all engine makers will appreciate a standard greatly.

During the coming week the miscellaneous division will meet in Cleveland and the truck standards division meets again in New York before the end of the month.

Hatch Heads Perfection Spring Sales

DETROIT, MICH., Sept. 19—Charles Hatch, sales representative of the Perfection Spring Co. of Cleveland for the past 8 years, has been promoted to the position of sales manager of the company and appointed a member of the executive committee.

Hubbard Is Harris Engineering Co. V.-P.

BRIDGEPORT, CONN., Sept. 16—Franklin G. Hubbard has resigned as chief engineer of the mechanical department of the Western Electric Co. plant in Hawthorne, Ill., to become vice-president, a stockholder and director of the H. E. Harris Engineering Co., this city. The Harris company, in addition to the engineering business connected with its special machine tool and gage shops, turn out taps, dies, thread gages, ring and plug gages, tapping, grinding and notching machines, etc.

Three More M. & A. M. Members

NEW YORK CITY, Sept. 19—The three following concerns have been elected to membership in the Motor and Accessory Manufacturers: Au-To Compressor Co., manufacturer of air compressors, bumpers, tire holders, connecting rods, etc., 233 Mulberry Street, Wilmington, Ohio; F. W. Mann Co., manufacturer of automobile jacks, Milford, Mass.; and West Side Foundry Co., manufacturer of tire pumps, Troy, N. Y.

Buckwalter Is Timken Bearing Engineer

CANTON, OHIO, Sept. 16—T. V. Buckwalter has been appointed chief engineer of the Timken Roller Bearing Co., this city.

Myers with Fageol Motors Co.

DETROIT, MICH., Sept. 18—Cornelius T. Myers, who is engaged in consulting work on automobiles and tractors here, has been retained as consulting engineer by the Fageol Motors Co. of California. Mr. Myers recently resigned as manager of the Timken-David Brown Co., previous to which time he was mechanical engineer of the General Motors Co.

Woodruff Is Simplex Asst. Sales Mgr.

NEW YORK CITY, Sept. 16—The Simplex Automobile Co. has appointed A. A. Woodruff assistant sales manager, with offices at 60 Broadway. Mr. Woodruff will have charge of office routine and system and the spare and repair parts business. He will also remain manager of the body department.

Porter Is King Asst. Sales Mgr.

DETROIT, MICH., Sept. 16—Joseph Porter, who has been manager of the King Car Corp., New York City, has been appointed assistant sales manager by the King Motor Car Co., Detroit.

Mutual Motors Promotes Two

JACKSON, MICH., Sept. 19—D. B. Williams has been elected secretary of the Mutual Motors Co., this city, and will have entire direction and supervision of sales and advertising. Mr. Williams has been associated with President Handley of the company for several years.

W. T. Miller, formerly connected with the Willys-Overland Co., has been elected treasurer of the Mutual organization.

Beecroft Talks S. A. in Cleveland

75% of S.A.E. Section Attend—Akron and Toledo Well Represented

CLEVELAND, OHIO, Sept. 15—Over 75 per cent of the membership of the Cleveland section of the S. A. E. was present at the opening of the fall and winter season to-night, when David Beecroft, Directing Editor of THE AUTOMOBILE, gave an illustrated talk on automobile conditions in South America. Over 100 lantern slides showing roads, automobile salesrooms, garages, and country conditions in Argentine, Brazil and Uruguay, were shown. Many of the tire interests of Akron were represented, as were factories in Toledo and other outlying towns and cities.

The fact that 8.5 per cent of the entire automobile business of the fiscal year ending June 30 of the U. S. A. was export business shows the prominence which this branch of the work is attaining. The Argentine market for automobiles is particularly attractive to-day because of the poor wheat crop in Minnesota, the Dakotas, parts of western Canada, etc. A poor wheat crop in these sections means better prices for Argentine wheat. How Europe is watching the grain markets in North and South America was well illustrated by the fact that as soon as our wheat reports were published prices in Argentina started rising. One large automobile manufacturer received a cable order from his Buenos Aires representative the following day for more cars. The selling season in Argentina and Brazil opens in November and continues to March, so that any present increase in Argentine wheat is going to have a very substantial influence on the selling of our U. S. A. cars there during the next 8 months.

Larger Sales Expected

Until a few months ago Argentina had a very large percentage of her last wheat crop on hand. Argentina is not blessed with a great system of grain warehouses at railway depots, as in U. S. A., Canada and Australia. As a result, the farmer has stored much of his crop of the farm, holding it for higher prices. During the last 12 months the Argentine farmer has suffered with his wheat because Europe has been buying from U. S. A. and Canada in preference to South America, solely because of the shorter freight haul between New York or Halifax and Europe as compared with Buenos Aires and Europe. This preference toward North America has held back automobile sales in grain-producing parts of South America, but the present prices show a return to the South American field.

ACCESSORIES In South America

Part V

Co-operative Selling Must Receive More Attention—European Competition Will Follow Close of War

By David Beecroft

¶ EDITOR'S NOTE:—*This is the fifth of a series of articles embodying the close observations of automobile and general trade conditions in South America made by Mr. Beecroft, Directing Editor of* THE AUTOMOBILE, *during a 10-weeks' trip through Argentina, Uruguay and Southern Brazil. As a delegate of the United States Government and member of the Argentine Return Visit Committee, Mr. Beecroft had exceptional opportunities to become intimately familiar with conditions in South America, and his articles bring out the salient points forcibly.*

CO-OPERATIVE selling of U. S. A. accessories in South America will have to receive more attention than it has in the past. It is too costly for a manufacturer of one accessory to open agencies in South America, but that one maker can combine with six, a dozen or a score of other makers. Such co-operative selling would, in addition to reducing marketing cost, develop a highly-needed brotherly spirit among our U. S. A. manufacturers.

We must largely forget competition among ourselves and keep our eye on international competition. International competition is a new phrase, but it is a stern reality in South American business.

After the war unquestionably the allied nations will among themselves co-operate in every way possible. That program has already been indicated. Our tire makers instead of fighting among themselves for business will have to co-operate to meet the trade war of England, France and Italy.

It would be a good investment for our accessory and parts manufacturers to adopt general policies with regard to South American trade, supporting such policies as work for the general benefit of our goods. There will arise many broad programs of policy that have to be handled and different U. S. A. firms should be a unit in such. Such united action will give our entire accessory trade a status that cannot be otherwise obtained; without such our makers may exhaust their energies in trade strife among themselves.

We Must Reduce Prices

In the matter of prices and terms of payment this co-operation is essential. Some U. S. A. goods are being sold at too high prices. This is due to their being handled through exporters rather than by the manufacturers direct. As a result our goods are getting and already have a reputation for being high priced. Certain U. S. A. tire repairs are being used solely because the French goods cannot be obtained. The South American dealers know our prices are too high, but they must have the goods. After the war they will go back to European goods just as fast as they can unless we change our policy.

There is a chance, a good fighting chance, that we can hold this trade providing we put our prices at once where they should be. It is short-sighted policy in building up an export trade to exact high prices to-day simply because you can get them, only to lose the trade to-morrow when international competition is renewed. Our makers can arrive at better understandings in the question of price by co-operation, getting together and going into South America with a united U. S. A. price situation.

One of the greatest factors in international trade that we will find of importance in South America is the reputation of our U. S. A. goods. Every firm that gets a bad reputation hurts the entire U. S. A. business. If U. S. A. accessories have a good reputation, then it will be easy to do business there. If our goods have a poor reputation, it makes it harder for every concern to enter that market.

Enter the Market Directly

There are many U. S. A. lines of accessories on the Argentine and Brazilian markets that are not trade marked goods. There is no manufacturer's name attached to them. The goods are not always reliable. There is often no service connected with them. Often the goods do not arrive in good condition. Sometimes they never function as they are intended to. The net result is a general discredit to our goods.

This has happened in scores of cases. A few examples will suffice: We have told of the shipment of defective hand horns, of poor lubricating oil, of cheap polishes for bodies and metals, and we could cite many others. Not a single one of these lines was trade marked. The Argentine did not know who made them. To him they were U. S. A. goods and you could scarcely blame him for gaging all of our accessories on their plane. We would do the same thing. This must be avoided. How?

The quickest and best way to overcome this deplorable situation is for our makers to enter the market directly. We must let the South American people know who are our big reliable markets. We must let them know that we make goods to which we are not ashamed to attach our names. We must let them know the good brands we manufacture. We must let them know that these non-trade marked goods are our poorest lines, not our good lines—let them know that we have a big army of accessory makers of high business caliber.

We must go further: Often some of our best U. S. A. lines are poorly handled in Argentina and Brazil, although they are excellently handled in U. S. A. This is generally due to the goods being shipped abroad through exporters. Naturally the exporter has not the same single interest in any accessory that the maker has. To the exporter any accessory is only one of hundreds of different lines he exports. The exporter does not understand the line the same as the maker. Often the exporter ships goods not well suited to the needs, and naturally the reputation of U. S. A. goods suffers. Here is an example:

A large Brazilian automobile dealer, to get the agency for a certain Detroit make of automobile cabled his exporter in New York to ship him five or six cars. If they turned out well he would secure the agency. The exporting house shipped a couple of coupés, one sedan type, a runabout and a touring car. The only model that was of any use was the touring car. There was no demand for coupés or sedans. There was no demand for runabouts. The demand was only for touring cars. The net result was that the dealer did not close the agency. He blamed our maker for the shortcoming of the exporter. Our international reputation suffered. Search revealed the fact that the exporter got a special price on the lot.

Here is an example from the accessory field: A supply house wanted hand horns, and the exporter shipped electric motor horns. The electric horns were no good without batteries, but as the supply house wanted to sell the horns for European cars using gas lighting, the motor-driven horns were no good. Here again our international reputation suffered and it always will suffer so long as our business is done through third parties who are not close enough to the needs of the industry to know best what line of goods is best suited for the case. It is for this reason that our makers must give the matter more attention.

What is true in South America in this accessory matter also applies to Australia and South Africa. Recently we talked to some of the largest dealers from Australia and South Africa and they both told us the same story. Our makers have a notoriously bad reputation as exporters. We are the laughing-stock of the world. Too many of our makers have no conception of the magnitude of foreign business. Here are two examples given in the last few weeks:

Foreign Trade Underestimated

One of our manufacturers sold the entire right of selling his accessory in all British South Africa for one trifling order of $120. This represented just twenty of the accessories in question. The South African jobber cabled for an order of several thousand within 3 months. The original order of twenty were sold in less than a week. Here our manufacturer gave away a good business investment, because he had no conception of the field.

Another example of similar bad business was where the sole right for an accessory was sold for $160 for an entire continent.

Both of these examples represent the other extreme, but they go to show what a poor grasp we have of the exporting business.

Some of our largest accessory makers in U. S. A. are not in any of the foreign markets direct, but are having their lines handled through exporters. In some cases these goods have a very unsavory reputation. In the words of one large foreign jobber, "some of your goods literally stink because of the way in which they are handled abroad." This foreign jobber mentioned half a dozen lines of accessories that are not getting established abroad for this reason. Here in U. S. A. they are our biggest firms.

As accessory makers we will have to do the same as older business concerns have done, namely, establish our own agencies direct or open our own branches. We have accessory houses that are larger than many old established lines controlling their own foreign business. Look at some of these that have their own arrangements and who are literally saving our U. S. A. reputation abroad.

Fairbanks Morse, Singer Sewing Machine, National Cash Register, Remington typewriter, Underwood typewriter, International Harvester, General Electric, Westinghouse, U. S. Steel Products Co., Corbin Screw Corp. and many others are our trade stalwarts in South America. They have found it worth while to send their best men there. These firms have not only built up a reputation, but they have spent millions to establish what standing we have as international traders.

Must Do Our Share

The automobile industry is duty bound to give these firms its support. There is no question but that we will be strong in that market, but we must carry our due share of the load. Bowser has an agency for its tanks in Argentina and already has established itself in the market. A few of our makers of dry cells have Argentine agencies and nothing but favorable comments are heard regarding their business arrangements. Our largest tire makers are establishing themselves in first-class manner, and they merit credit for what they have done. But there are too many of our accessory people who have not awakened to the situation.

Wider Representation Needed

We have not to-day a wide enough representation in such lines of accessories as speedometers, batteries, spark plugs, jacks, horns, polishes, bearings, vulcanizers, wrenches and other lines of tools. Many other lines can be added.

Before concluding this series on accessories there are a few other lines that should be included with those referred to in previous articles. There is a strong demand for top materials, providing they are cut for several of the best U. S. A. sellers. Tops wear out very quickly in Argentina and Brazil and the owner wants top materials all cut ready to be applied. This is true with regard to Ford, Overland, Studebaker, Hupmobile, Buick and a few other makes and will be true with regard to many more different makes within the next year or so.

Several of our magneto makers are already well established, Bosch and Splitdorf being represented. Eisemann has representation through France. Our concerns making electric starting and lighting apparatus are not strong. There is scarcely any carbureter representation, and as near as we could discover the European carbureter is much more firmly established than our own. Several of our own makes are scarcely known and some never heard of. With many of our cars selling in those countries there will be marked development in the carbureter possibilities. The same applies to rims, clocks, shock absorbers, and every line of accessory that is going to add to the utility of the car.

Manufacturers of raw materials will find a good market in Argentina, Brazil and other Latin-American nations. Every large supply house in addition to accessories carries a heavy stock of blanks from which spur and bevel gears of any size can be made.

There is a big supply of gaskets, assorted nuts and bolts, spring clips, bar and sheet steel stock, door hinges, door handles and, in short, everything needed in the automobile. Keep in mind that South American countries are not manufacturing nations, and so practically everything must be imported. The supply houses handle not only accessories, but raw materials as well. Often raw materials occupy as much space in a store as accessories.

In conclusion: The field is there. Let us possess it as it should be possessed.

Tractor Drives Knotty Problem

Advantages of Caterpillar, Two-Wheel and One-Wheel Drives Appear to Depend Upon Nature of Work—Difficulty of Choosing Best Place for Weight

By A. Ludlow Clayden

Left—Large Case tractor, showing the sort of treads used to give a grip on plowing land

Below—The "Happy Farmer," a tractor in which the weight is very little forward of the driving axle

This is the third of a series of articles based on an intimate study of tractor requirements and the efforts of the tractor engineers to meet the problems in design and construction arising from the demands made upon the machines in active service. The author has been in close touch with the tractors and the manufacturers at the recent demonstrations, so that this series of articles accurately reflects the conditions discussed, besides giving a clearly defined idea of the principal trends in tractor engineering.

IN a previous article the writer touched upon some of the high spots in the design of engines for tractors, and H. L. Horning of the Waukeshaw Motor Co. has contributed much valuable detail information on the same subject in his recent S. A. E. paper, the third installment of which appears in this issue of THE AUTOMOBILE. A matter on which there is even more difference of opinion, and which is far more difficult to argue about is the best form of wheel or drive arrangement for tractor service.

At present we have almost all possible arrangements. One wheel with a pair of small wheels, one to steer and one to maintain balance sideways, is used by some manufacturers, this being called the drum type. Then we have two driving wheels with either one or two steering wheels that are supposed not to carry much of the weight. Then come true three-wheel and four-wheel machines with a fair proportion of the weight on the steering wheel or wheels, and finally, there is the track-laying type with the wheels inside an endless chain which is placed on the ground and rolled over by the wheels. There are also machines with a track-laying arrangement for the drive, and a wheel or wheels to steer and carry part of the weight.

The track-laying type is usually known as a caterpillar, although this particular phrase is claimed to be the property of one firm and so not available for general use. However, it is the term commonly employed and will therefore be used by the writer in dealing with all applications of this kind of drive.

It is unlikely that one form of drive is the best for all purposes; there are reasons which make different designs most suitable for different circumstances. For example, there is nothing to compare for a moment with the caterpillar for operation on very soft ground. The unit pressure is small and the tractive grip the maximum possible for the weight of the machine; so on peaty soil or sand or for hauling guns through wet dirt there is nothing which will compare with the caterpillar, yet for use on hard ground it has drawbacks which make the wheel design preferable.

However, to look at the fundamentals of the problem of choosing a drive, we have first the necessity for providing enough grip between the drive and the ground to prevent the slipping of the drive by the engine under any circumstances. The caterpillar offers the maximum traction having one surface in contact with the ground and all the weight upon it. The automobile offers the other end of vehicular range with small surface and half the weight on it. Average tractor requirements are somewhere between these two extremes.

As a second requirement we need a drive, if we can get it, which will have a tread no wider than the strip of earth that can be plowed. If we can pull four plows, the drive ought not to be more than four plows wide, six plows and it can be half as wide again and so on.

Third, we want a direct pull for the plows, the center line of the drive should also be the center line of whatever the tractor is pulling, thus avoiding side draft, which is obviously wasteful of power.

Fourth, if we do not need the extreme limit of the caterpillar we still want sufficient area of contact on the ground to provide traction on moderately soft earth.

Fifth, we want ability to turn in a small circle, a very small circle, so as to facilitate maneuvering in confined spaces and to allow plowing to be carried as near as possible to the limits of the field.

Drawbacks of Caterpillar

Before passing on to the consideration of wheeled machines, the drawbacks of the caterpillar type may be mentioned, because this is the ideal for traction per pound of weight and for maneuvering, because by going ahead on one tread chain and astern on the other it is possible almost to spin around the caterpillar in its own length.

The difficulties are mechanical. Obviously a steel chain must have links and links must have bearings. A steel chain to be efficient and to have long life ought to be inclosed in an oil bath; it most certainly ought not to be forcibly charged with mud and sand. Thus the work absorbed by the caterpillar tread is considerable, and the life of the chain is not all that could be desired. For steering we must drive one side more than another, so that directional control is somewhat complicated, and finally, the chain tread is rather expensive, and cannot well be cheapened if it is to last reasonably well in service.

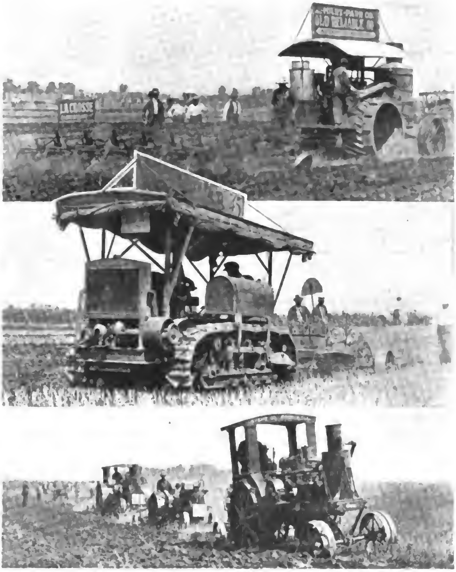
This is not an indictment of the caterpillar, it is merely a brief summary of its drawbacks. It is probable that means could be devised for rendering the bearings in the chain tread perfectly dirt-proof and thus increasing the efficiency and the life of the chain. Really the caterpillar seems to be a particularly promising type of machine which will develop into something far better than it is to-day. Numbers of the machines are being used where they are the only thing that possibly could do the work, and the experience gained will be valuable in bettering the design. Thus it is hardly possible properly to fix the place of the caterpillar in the tractor world at present; it will not be possible for some time to come, it may even be 10 years before the type is developed fully.

There is another sort of machine using a caterpillar drive in conjunction with wheels. In this a small chain tread assembly with two wheels is located suitably for driving and the weight is balanced, partly supported and steered by wheels. This system gets away from the complicated steering of the full caterpillar and provides a good driving grip without the use of a very large and wide driving wheel or wheels. The chain being smaller is less costly to renew when worn out, so that this design may possibly develop along with the full caterpillar.

A possible trouble with a large and powerful tractor might be to get enough weight balanced on the tread; in other words, there may be a limit of size where the caterpillar drive with wheels for steering would be no better than an all-wheeled machine on traction and general convenience.

Drum Suits Small Power

In the drum type of tractor there is one large wheel with the engine and gearing located as close as possible to one side of the wheel. There is then a smaller side wheel which does no driving, but carries a little of the weight, just enough to allow the tractor to lean over in the direction away from the side wheel without overbalancing. A third wheel somewhere ahead does the steering.



Upper—A large tractor hauling eight plows wider than itself. The extension pieces on the wheels to give support for the weight in soft going should be observed

Middle—The Holt caterpillar with weight distributed evenly over the whole tread of the chain

Lower—The big Avery in the foreground has the weight well in front of the driving axle of the machine

Upper—The Bates Steel Mule has a caterpillar rear drive and the two front wheels are for balancing the weight and steering. Only a part of the weight is on the driving member, yet the traction is sufficient for all purposes

Lower—An example of the drum type where the drive is taken through a single large wheel, the weight being balanced by a side wheel and partly supported by a front wheel which does the steering

The advantages of this design for small power is that the one big wheel does not need to be wider than the strip that is covered by the plows the machine can pull, which means that no driving wheel has to run on ground already plowed. Against this advantage may be balanced the drawback noticeable in drawing harrows or other cultivating machines, for then the drum packs the earth in strips a few yards apart and the light dragging of the wide machine being towed is not enough to unpack the soil. This, however, is also true of all other types of tractor, and the packing caused by a drum is no worse than that caused by two wheel drives if the unit pressure is the same.

Another advantage of the drum type is that there is no need for a differential, there is no rear axle in the ordinary sense and the engine and gearing can be arranged compactly. Also, not being between two big wheels, the power-plant can be very accessible and yet have the bulk of its weight concentrated on the driving surface.

Required Driving Pressure

Before proceeding with this analysis of drives, it may be well to mention the amount of unit pressure required to give the requisite tractive effort. At present this must remain something of a guess, it is not possible to say that it must be just so many pounds per square inch. However, it is a fairly safe rough and ready rule, with wheeled drives, to say that the weight must be equal to the tractive effort.

In considering tractor engine requirements it was suggested that at least 1000-lb. drawbar per plow was necessary, so this means for each plow pulled the weight on the driving wheels should be 1000 lb. Some engineers think this amount too much, others say it is too little, and this again is a matter that experience must decide.

However, whether we accept the 1000 lb. or not, this does not help to settle the proper width of wheel. The traction depends upon the pressure, not upon the area, so a large area with small unit pressure has just the same tractive ability as a small area with higher unit pressure, as long as the nature of the surfaces in contact is the same. What is necessary is to have the wheels so wide that they will not sink into soft earth nor have too powerful a packing action on freshly plowed soil, which means they should be as large as possible. Against large size is weight, for the big wheels are not light and there is everything to lose and nothing to gain by making the total weight on the drivers more than that required to give traction enough for the plows.

Of course, the co-efficient of friction between the wheel and the earth is very high, and it is customary to increase it greatly by putting studs in the treads or bars across them. There is no difficulty in using high unit pressures and small wheels on dry earth, but a small wheel will soon dig itself in on soft going. Here we see the advantage of large diameter as compared with great width, for the big wheel will roll out of a deep hole that might engulf a smaller one. Getting a tractor weighing 4 or 5 tons out of a hole in a soft field is somewhat of an undertaking if another machine is not on hand to do some towing.

Really for wheel diameter and width little more can be done than to refer to current practice and then experiment, but a good deal can be done in utilizing the weight of the engine and transmission to better advantage. In the diagram, Fig. 1, suppose that the driving wheel has a center O and that the drawbar pull P is applied at radius r. Then, if there were no other wheels, but the power plant had all of its weight on the one axle O, obviously it would have to be located back of the axle with the center of gravity at W, so that $Wr1 = Pr$.

If the weight is further forward and there is a front wheel to support part of it, the effect of the P is to throw a reactive pressure on the front wheel. In Fig. 2 obviously $Pr + Wr1$ must equal $pr2$ where $r2$ is equal to the wheelbase of the machine. In Fig. 3 we have the steering wheel behind, and then the effect of the pull P is to lift the rear wheel; when $Pr = Wr1$ then $p = O$.

We can thus say that we are utilizing the weight best when it is back of the driving axle, but if it is in this position it must be a good way back so as to maintain enough pressure on the steering wheel to give a grip and prevent the wheel from being lifted off the ground. Even then striking a stump might cause the whole mass of the tractor to revolve around the axle.

If the weight is in front it is not being utilized to best advantage, but we have safety and can be sure of steering grip. If the weight were right over the rear axle so that it was balanced there with no drawbar pull, we should have the condition of $r1$ equaling O which is the best compromise. Here again it must not be completely balanced or there will be no steering grip when the tractor is running by itself and no stability to prevent it turning backward around the axle should the front wheel strike a bump. Therefore the conclusion reached is that the best place for the center of gravity of the engine, transmission, etc., is just sufficiently forward of the driving axle to give steering on the front wheel.

From this elementary bit of mechanics it is possible to see where the caterpillar scores with its small wheels, for small wheel diameter means that the radius r is also very small. If we could get r down to O, the pull P does not disturb the balance of the weight in the slightest. It also follows that the larger the wheel the more difficult it is to find the best place for the center of gravity, to suit all conditions and without wasting weight that might be utilized in obtaining tractive effort. There appears to be something in favor of a four-wheel layout with two driving wheels and two steering wheels, one in front and one behind. Here the weight could be poised so as to have the best effect at the maximum drawbar, and one or other of the small wheels would balance the machine under other conditions. There is no doubt, though, that three or four wheels with the steering in front and the center of gravity a little forward of the driving axle makes a quite satisfactory compromise.

In practice there is a very great deal of variation, and it is impossible to escape the conclusion that not all tractor engineers have given this question of weight distribution the attention it deserves. As long as there is enough weight for driving and steering every additional pound is dead weight, costing many dollars a year to carry about and something in first cost. In most cases the wheel size necessary will force the wheels to be fairly heavy in themselves and the rest of the machine should only add just enough more weight to bring the total up to the amount of the maximum drawbar the machine can exert.

Turning to a matter of detail, it is noteworthy that the suspension form of wheel is greatly used for tractors, though the tangent spoke principle has apparently been neglected. If a wheel is to be a tension wheel it can be built lighter for the same strength if it is on the tangential spoke principle.

Improving Wheel Tread

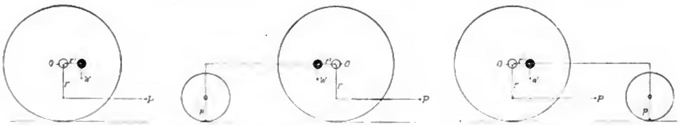
A wheel detail that seems capable of improvement is the method adopted for attaching the bars or studs to give traction on softish dirt. If tractors with studded wheels are run on macadam or other hard roads the destruction caused will be indescribable, yet the farmer wants to be able to use his tractor on road or farm. Thus it ought to be easy to change from the field tread to a smooth tread quickly. Many tractors have angle iron tread bars about 12 in. apart all around the driving wheels, each being attached by two or three bolts and nuts, to remove which would be three hours' work or more for one man. Similarly the studs often employed are each fixed individually. There ought to be some way of applying the whole rough tread for field work in two or three sections per wheel, so that the tread could be put on or removed in minutes instead of hours. There is no great mechanical difficulty to be overcome and such provision would meet the road destruction question before it actually arises; surely this is well worth while.

A way of fitting a rough tread which suggested itself to the writer and seems to have some possibilities, would be to make the tread in sections say a foot long, the sections being linked together by hinge pins so that the whole tread made a kind of chain. This could be laid on the ground flat and the tractor driven onto it, then the ends could be lifted up and the tread tightened on the wheel by some sort of turnbuckle which would cause it to grip. Probably some driving catches or dowels would be necessary at several points on the tread, to prevent the wheel tending to turn within it. Even if this suggestion is not practical, and very likely it is not, there ought to be some equally simple method that could be developed.

A typical four-wheel tractor with the weight well forward of the driving axle

At present all the two-wheel drive machines have a differential, and they could not be operated without one, but there is a prevalent opinion that a differential lock is an essential attachment, and that few tractors will be made without this in the future. Considerable interest is being taken by tractor men in the various differential gears that have recently come to the front and have the power to prevent the spinning of a wheel that loses traction. If one of these works out satisfactorily in tractor service it can have the whole tractor market, and the makers of such differentials would probably find it well worth while to make a special bid for this large and growing field.

Automatic steering has been sought on a good many of the small tractors, the idea being to allow the driver to relinquish the wheel in order to attend to his plows. Steering in such case is effected by a small wheel that runs in the furrow, while plowing, and has a link connecting to the steering gear at some convenient point. In the field these devices appear to operate very well indeed, and, even if two men are working together, there is no object in compelling one of them to hold the steering all the time if that is not really necessary. The additional amount of mechanism is small, the cost negligible and the added weight also too small to be of any account, so there is no obvious reason why automatic steering should not be used even more extensively than it is. Of course, it is more readily applicable to a small machine where the amount of force needed for steering is small than to a big machine.



Left—Fig. 1—With a driving wheel center O and drawbar pull P applied at radius r, all the weight of the power plant being on the one axle, the center of gravity would have to be behind the axle at W. Center—Fig. 2—With the weight farther forward and partly supported by a front wheel the pull P throws a reactive pressure on the front wheel. Right—Fig. 3—With the steering wheel behind pull P tends to lift the rear wheel

Temperature Control Will Be Elaborate

Need for Different Temperatures in Different Parts of Automobile Engines Will Lead to Many Automatic Devices is Opinion of Detroit Meeting

C. F. KETTERING, the man who held the rapt attention of the S. A. E. for a whole evening while he lectured on scientific matters on the Noronic last June, started a wonderfully interesting discussion at the opening meeting of the Detroit section of the S. A. E. on Sept. 14. He read no paper, nor did he speak from notes, but simply talked for an hour on the problems of temperature control in automobile engines, citing the difficulties and hinting the methods by which they may possibly be surmounted.

The conclusions reached after the lecture and the discussion were that heavy gasoline would compel temperature control on automobile engines, and that such control would probably extend beyond that of the water temperature alone. Engineers were started along the line of thought required to bring definite results, and a whole field of necessary investigation was opened up.

The conclusions were indefinite, that is to say no participator in the discussion could say just what ought to be the temperatures of different parts of an engine; perhaps the most immediately interesting part of the proceedings were the remarks made regarding the problem of starting from cold, C. F. Kettering suggesting the use of electricity and Howard Marmon the employment of a burner or pilot light to bring the carbureter and cylinders up to proper operating condition. The drawbacks of over heating were given attention as much as those of under heating and it is safe to say that hardly a man of the large roomful present but went away with his mind set on a problem he had so far considered in only a cursory sort of a way.

Heat for Vaporization

Kettering began by pointing out that a certain amount of heat is necessary for vaporizing any liquid fuel, that an engine burning so many gallons of gasoline per hour requires so much heat to be taken from somewhere in order to vaporize that gasoline; a perfectly definite quantity independent of anything else.

Kerosene requires more heat than gasoline, of course, but the amount needed is still constant for a given bulk of fuel. With light gasoline, like we used to have, the heat could be taken from the atmosphere over a wide range of air temperatures. But this is no longer the case. We must get extra heat from somewhere. Electricity, the ideal form of energy for easy control, was out of the question, far too much heat is required to vaporize heavy gasolines. Also we are now wasting about 50 per cent of the total thermal value of fuel in the cooling water and another 40 per cent in the exhaust gas, so we have only 10 per cent left and do not want to use any of this for vaporizing the fuel. We may either take from the waste heat of the water or of the exhaust for that purpose.

Later on in his discourse Kettering mentioned that electrically derived heat might be used for heating up a carbureter previous to staring, that is, before exhaust heat was available.

Ill Effects of Condensation

There are bad effects through not heating the intake gases sufficiently, effects that may cause actual damage to the engine. In a heavy gasoline, such as is being sold to-day, there are still some light fractions, added to bring down the gravity of the whole. In starting, or in running with an intake that is too cold, these light fractions are vaporized by the heat of compression and burnt out of the gas mixture during combustion, leaving the heavy fractions partially unconsumed.

This action causes a condensation or deposit of heavy kerosene which dissolves in the lubricating oil, thinning it and reducing its lubricating properties, and long continued running with this action going on will certainly cause cylinder and bearing wear. (This has been found to be particularly true with tractors running on kerosene, and for such machines it is recommended that all the oil in the engine be thrown away after 10 or 15 hr. running.)

Running on Half Throttle

A similar effect is obtained by running on half throttle, as most cars are driven most of the time. The depression in the intake caused by the throttling causes wet deposits of fuel to be made in the intake passage; these get into the cylinder and the evil effects of the heavy fractions are noticed. The only way to prevent this condensation is so to heat the manifold that it will supply enough heat to the fuel to keep it in gaseous form. The fuel must not only be made into a gas while in the carbureter, but must be kept in gaseous form while passing through the manifold into the engine.

Granting that once the engine was well warmed up it would run on quite heavy fuel, as long as proper heat for vaporization was supplied, Kettering turned to the problem of what constituted a fuel on which a start could be made from cold. He stated that, at normal air temperature, a fuel consisting of 1 qt. of 60 Baumé gasoline mixed in 5 gal. of 46 to 47 Baumé kerosene would enable starting to be performed, the light fraction doing all the work till heat was available to warm the carbureter and manifold. Such a mixture is just about the equivalent of 54 Baumé gasoline.

A method of supplying heat that has been tried and may have some usefulness is to warm the bowl of the carbureter, heating the fuel till its specific gravity is reduced to the desired Baumé. This, however, is not the equivalent of supplying heated air, as the warmed fuel can only hold enough heat to provide a small portion of what is required for total vaporization. Thus we want hot air, but not too hot because by decreasing the density of the air we reduce the weight of air and fuel that the cylinder can draw in, and so cut down the power possibilities of the engine.

Water Heat Insufficient

To get proper vaporization under all circumstances with heavy fuel it is not enough to control the temperature of the water in the cylinder jackets. It will be necessary to control the temperature of the fuel itself and also of the air entering the carbureter, if we are to get ideal results. The kind of thermostat now being employed for water control is very powerful, though small in size it can exert considerable pressures and could be used for operating all sorts of mechanisms, so there ought to be no very great mechanical difficulties in the way.

The use of a mechanism to control water temperature for internal combustion engines is not new, as long ago as 1885 a device had been patented for use on stationary gas engines which had as its purpose the maintenance of a constant jacket temperature. Other inventors had followed, the designs growing simpler and more effective, so it is rather remarkable that it is only recently that any attention has been given to this matter in the automobile field.

J. G. Vincent, Packard Motor Car Co., opened the discussion by saying that he had 2 years' experience of thermostatic control of cooling water and his work had shown him that there were slight differences in effect, according to where the thermostatic valve was placed. With the thermostat at the bottom of the water system it controls the temperature of the water entering the cylinders, but when placed at the top of the radiator it controls the temperature of the water leaving the engine jacket. While there might seem to be little difference, there is really a good deal.

Under normal operating conditions the amount of difference is small, but in cold weather the engine with the thermostat controlling the outlet from the cylinders where the water goes into the radiator, there is a considerable difference in the time taken to warm up the cylinders to proper working temperature.

Thermostat Operation

With the bottom position for the valve and thermostat it was set to close at 115 deg., and to open at 125, keeping the water at the bottom of the engine jackets at about 120 deg. What will then be the temperature of the water as it leaves the jackets at the top is variable, depending upon the weather.

On the other hand, if the thermostat and valve are at the top, so that the valve controls the outflow from the engine, then it would be set to open at between 160 and 170 deg. Until this temperature is reached no water can escape from the jackets. As the water grows warmer it rises into the cylinder heads and is trapped there till such time as the thermostat opens the valve.

Thus with the thermostat at the top the temperature of the cylinder head cannot be less than the required amount, but when the control is at the bottom the water in the heads may be too cold. Furthermore, with the top position the water cannot get any hotter than the set point (160 to 170 deg.) while it may get too hot if we control the bottom part of the system.

The engine warms up much quicker with the valve at the top, and tests showed a Packard engine would come up to working heat in 1½ min. with zero atmosphere. Vincent called attention to the fact that the valve must be tight if it is to be of any use.

Radiator Shields Alternative

Several Detroit manufacturers are now trying out a device consisting of a number of shutters mounted in front of the radiator which can be closed or opened by the action of a thermostat. Mr. Lewis, the Detroit Motor Appliance Co., interested in this device, called attention to the fact that it nullified the effect upon the water in the radiator of varying wind conditions. He allowed that heating up after starting would be slower when the whole body of water has to be warmed but thought there were advantages in having the radiator kept automatically from becoming too cold. A. P. Brush, who spoke later, also pointed out that one desirable effect of a constantly warm radiator was to heat the air which the carbureter was taking in, and so utilize some of the heat wasted in the water for performing a desired function.

A. Ludlow Clayden, THE AUTOMOBILE, spoke concerning the effect upon the problem of intake gas velocities. In attempting to carburate heavy fuel we have only the atmospheric pressure of 14.7 lb. per square inch to drive the air past the nozzle and so atomize the fuel. As atomization becomes more difficult carbureter makers are cutting down the size of choke tube so as to increase the velocity past the nozzle, and this increases the depression in the manifold and so aggravates the trouble of condensation.

Gas Velocity a Factor

Particularly in using kerosene it is noticeable that we require more heat for the intake manifold at low throttle, when less is available, and less heat at high throttle, because the tendency to recondense after atomization is increased as the depression in the manifold is made greater. It would therefore seem that there might be good reasons for controlling the amount of heat given to the manifold in proportion to the speed of the gas passing the carbureter nozzle.

He added that electricity seemed to be the ideal energy supply for warming up for starting purposes, and asked Mr. Kettering if the amount needed to warm the bowl of the carbureter sufficiently would be too heavy a demand on the battery. This question was afterwards answered to the effect that the current required would be some 30 amp. for about 2 min. duration and therefore not beyond a battery's capability.

F. O. Ball, Ball & Ball Carbureter Co., stated that he had made some inconclusive experiments with integral intake and exhaust manifolds and was continuing these in the endeavor to discover what the intake temperature ought to be.

K. W. Zimmerscheid, General Motors Co., said that we were always likely to forget that gasoline and air must be mixed by weight and not by volume and that when we heated either, so altering its specific gravity, we upset volumetric metering set for different temperatures. He considered 170 deg. the ideal water jacket temperature and thought 140 deg. about the right temperature for an intake manifold. In arranging for heating the air taken in, the fact that we had to start with cold air must not be forgotten. He considered the best temperature for the entering air would be 120 deg. The fuel ought to be kept at a constant temperature. If the carbureter were insulated from the cylinder block by some non-conducting material it would be easy to control its temperature by means of a thermostat, using an individual water jacket for the instrument. Possibly a carbureter maintained at 120 deg. and an intake manifold at 180 deg. would be correct.

It was also desirable to prevent the temperature of the oil from falling too low. There is always risk of getting water in oil through condensation of the products of combustion that get past the rings and pistons. Probably this water passes the pistons in the form of steam, and, if the crankcase is warm, it will not condense, perhaps, but will have a chance to escape through the breather.

Howard Marmon, Nordyke & Marmon Co., said that the starting trouble was one of the worst the industry had had to face. He found himself wondering whether the simplest solution of the difficulty would not be to use a blow torch or pilot burner playing on the manifold and carbureter to warm them up to working temperature. A. P. Brush, Brush Engineering Assn., who followed, mentioned that small quantities of light spirit would always be available, and it would be comparatively simple to use a small tank of good gasoline to start and warm up, switching over to the heavier fuel when the desired temperature had been attained.

Power of Thermostat

D. McCall White, Cadillac Motor Car Co., said that E. E. Sweet of his company began experiments in 1907, and it was his tests that led up to the adoption of the thermostat by the Cadillac company. He gave several tabulations showing the characteristics of the thermostatic unit they employed. The following table shows the amount of expansion at different temperatures:

(Continued on page 482)

Truck and Tractor Engines—Part III

Water Pumps and Engine Cooling—Governor Design a Difficult Problem But Essential—Engine Lubrication—Application of Tractor Engines—Liberal Allowances Necessary

By H. L. Horning

Engineer and General Manager Waukesha Motor Co

¶EDITOR'S NOTE.—This is the concluding installment of the paper Mr. Horning read at the third quarterly meeting of the Midwest section of the Society of Automobile Engineers held in Milwaukee, Wis., Sept. 1. Previous installments illustrated the differences in the demands on engines for trucks and tractors, outlining some of the more serious problems the engineer has to face in meeting them.

COOLING passenger-car engines sometimes is a serious problem. Cooling is the greatest problem in tractor engines. There are so many variables that little reliable information can be given as to water circulation or radiator capacity. Each individual case seems to require its own treatment. A tractor may be sent to Alberta or to Texas, and the extreme conditions determine the radiator capacity as well as the water pump.

The following limits may serve as a rough rule for water pump capacity:

$$G = \frac{B.H.P.}{V} \qquad (5)$$

In which G = gal. per min. water pump discharge through outlet to waterjacket.

V = Variable depending on engine and radiator design. For poorly designed combination V = 3.5. For a very efficient design V = 4.5.

There are some tests being run by a well-known company on the capacity of different type radiators and fan designs for tractor service which will be available soon, and which will constitute the only complete information available.

Manifolds

The only change manifolds require for truck or tractor service is in the intake, which should be smaller than usual, due to the low maximum speeds of engines and to the poor quality of fuel. The following formula for truck or tractor intake manifolds on egines up to 5-in. bore results in gas velocities which give good results for engine speeds encountered in these services and are correct for the poor gasoline and kerosene service:

$$I = 0.3\ B \qquad (6)$$

in which I = core diameter of intake manifold. Exhaust manifolds outlet cores have diameter corresponding approximately with the following formula:

$$Ex = 0.5\ B \qquad (7)$$

Governors for Truck and Tractor Engines

Governors must be installed on trucks primarily to prevent them from racing. Truck users have found governors useful to maintain the maximum speed of the trucks so as to give the driver both hands and feet for driving on straightaway work. It has been found that constant-speed governors help to keep up the maximum speed of the truck or make a truck average more miles in a day.

Governors for tractors are constant-speed type and usually are of the flyball design, which act directly on the butterfly throttle.

By far the most satisfactory arrangement for governors is to build them into the engine and to have them lubricated by the engine lubricating system.

Time will not allow a discussion of governor design other than to say that it has been the most difficult phase of truck and tractor engines, with which the writer has had to contend, and yet the most essential. Experience indicates that the flyball type is the most practical and easily understood by the average user and any form of this should prove satisfactory if built with ample bearings and wearing parts. Experience is such as to indicate that the butterfly is the most difficult form to use while being the easiest to manufacture.

A paper before this Society on governor forms, in the writer's opinion, is the best that has been written.

Lubrication of Truck and Tractor Engines

Generally speaking, the difficulty in lubricating tractor engines efficiently is second only to lubrication of racing engines. They are operating between the speed of maximum torque and maximum economy, a range in which the greatest heating occurs, which is directly responsible for most failures in tractor lubrication. What is true of tractor engines under 50 hp. applies with equal weight to truck engines.

Lubricating systems for both services are no different than found in passenger-car service with the exception that greater care must be taken to insure an abundance of oil at all times and to see that the system is such that if one point fails other parts will contribute oil to prevent sudden failure, but not sufficient for extended service.

To illustrate, one engine is equipped with a lubricating system that is so designed that if one connecting-rod pocket fails to get its oil, the adjacent rods supply enough to spread the development of a knock over 2 days' time so that it can be heard and corrected before full failure. Most oiling systems fail so quickly at one point that there is no chance to catch the failure in time. Truck engine bearings fail for lack of proper oil and from the above cause. Successful lubrication of heavy-duty engines imposes two functions on the oil.

First, to make an oil film between wearing surfaces.

Second, to act as a conveyor of heat. As the duty of an engine increases it is hard to tell which is the most important. The writer thoroughly believes in the great benefit derived from a large quantity of oil washing the heat from the lower part of the cylinders and crankcase into the lower pan, where design should promote dissipation of this collected heat.

The importance of an abundant screen area for very thoroughly straining the oil becomes of great importance in heavy-duty work.

Geared oil pumps have been found to be the most satisfactory and dependable in service; the only points where they fail is in leakage of oil, both internal and external, and being not sufficiently large for the service.

Proper lubricating oil for heavy service seems to be one important insurance for long life.

The following general classification of oils manufactured by leading oil companies seems to fit the requirements and is given here rather than a scientific statement of oil characteristics. Oil companies produce oils graded as follows:

Light.
Medium.
Heavy.
Extra heavy.

Whereas most automobile engines will thrive on light oil, truck engines require medium and tractor engines require medium-heavy and extra-heavy. Truck engines run well in winter on light oil and operate best in summer on medium. Some tractor engines operate in winter, spring and fall on medium and in summer, heavy oil. These are the smaller tractor engines which do not have the piston clearance nor do they get as hot generally as the large engines which operate in winter, early fall and late spring on medium and summers on heavy or even extra-heavy.

In burning gasoline, engines do not usually get as hot as when burning distillate or kerosene. If an engine operates well at any one season on one grade or weight of oil while burning gasoline, it will operate better with a heavier oil burning kerosene. Full force-feed systems can use heavier grades of oils than splash systems.

There is still another reason for heavier grades of oils in tractor service or when burning kerosene which has been mentioned before under crankshaft specifications, namely the dilution of the crankcase oil due to loss of mixture past the rings. Two days' service using the same lubricating oil while burning either gasoline or kerosene will result in heavy dilution of the crankcase oil.

One instance comes to the writer's mind in which, after a day's run, there was a greater quantity of oil and kerosene in the case at the end of the day than in the morning. In gasoline engines the gasoline evaporates under the best conditions of operation, while kerosene remains. Ten days' service with kerosene without complete change of oil will bring the power of an engine down 20 per cent. In hot weather, the drop will be greater. Frequent renewal of oil or boiling off the lighter constituents before mixing with other oil helps considerably.

Fuel

The most serious problem at this time is the matter of fuel for truck and tractor engines.

The problem of burning so-called gasolines now sold is becoming very serious and the further the situation develops the greater necessity there is for starting on one fuel and running on another. This leads to the question of burning straight kerosene.

The writer has produced and put in service engines of the regular truck type for burning kerosene in tractor work, and probably has out 2600 kerosene-burning engines, some having run for 3 years. The following conclusions regarding kerosene burning can be drawn:

(1) In tractor service where the load range is within 50 per cent of full load, kerosene can be used with reasonable satisfaction by the use of properly proportioned combined intake and exhaust manifold, the starting to be made on gasoline.

(2) Under these conditions the loss in volumetric efficiency due to heating the intake charge results usually in a loss of 10 to 20 per cent in the maximum horsepower output, whether gasoline or kerosene is used.

(3) Where speed of engine increases, the necessity for heat in the intake decreases, while when speed decreases necessary heat in intake increases. At full speed and power output, very slight heating of intake will suffice.

(4) Trucks can be made to operate on kerosene by the means mentioned above. One truck has operated one season in a pea harvest on 6.4 gallons per mile on a 2-ton truck equipped with a 3¾ by 5¾ engine. On the same job with conditions as nearly identical as possible and in the same service, the truck made 7.75 gal. per mile on kerosene. On a run of 50 miles the same truck made 10 miles per gallon over city and country roads with gasoline while on kerosene it made 15.25 miles, both figures being for truck running half the distance with pay load and return empty. These figures were made in an attempt to produce the best performance and all figures are given to encourage the hope of progress along this line. The design and applications which were responsible for this performance are being put in commercial shape.

(5) The science and art of burning kerosene as indicated by experience and the results obtained in service are identical with the principles set forth in several papers by Prof. Lucke, and the writer takes pleasure in testifying to the correctness of both the scientific and practical conclusions contained in his papers.

(6) *Our experience is that a kerosene engine does not carbon any more than a gasoline;* in fact, stays cleaner than a gasoline engine if vaporization is only comparatively well done.

(7) Where kerosene is well vaporized so that the mixture reaching the cylinder is in a dry state, a kerosene engine with a correctly designed combustion chamber will not heat as much as a gasoline engine.

(8) Experience as to the function of various elements in burning any or all grades of fuel is expressed as follows:

The carbureter meters and atomizes the fuel.
The manifold must vaporize the mixture.
The combustion chamber burns it.

It will save many inventors much disappointment to know that of all the things mentioned above the carbureter is the most perfect for the work they have to do.

The manifolds are next in efficiency.

The engines in their present form are furthest from being able to perform their functions in attempting to burn kerosene.

The development of kerosene burning in engines of the prevalent types must start with the engine and end with the carbureter.

Application of Tractor Engines

While a definite knowledge of transmission and tractive resistance losses are necessary in order to make a rational design, engines are generally applied based on broad considerations. The average light tractor will show a draw-bar horsepower of 60 per cent of the brake horsepower of the engine. A poor tractor and design will deliver only 50 per cent, while the best never exceeds 70 per cent, and this figure is doubled by good authorities. The above performances are based on the tractor operating on good solid dirt footing.

Plows require a draw-bar pull from 300 lb. apiece to 1200 lb. This is for a 14-in. mold-board plow cutting 14 in. wide and 8 in. deep. An average would be 600 lb. per plow. The average day-in and day-out plowing is done at 2¼ m.p.h., which is practically 200 ft. per min. If, therefore, we solve for horsepower necessary to get

$$\text{Hp.} = \frac{600 \times 200}{33{,}000} = 3.6 \text{ Hp.} \qquad (8)$$

$$\text{or } \frac{3.6 \times 100}{60} = 6 \text{ brake Hp. average.} \qquad (9)$$

For average service it requires 6 brake hp. per plow or 1 hp. for every 100-lb. draw-bar pull at 2¼ m.p.h. Using the figures as given above, it will be easily seen that the maximum requires just twice the average and the minimum, one-half the average. Twelve brake hp. per plow for maximum plowing conditions would therefore be correct. A great many tractors are based on these figures, which are considered conservative. The most efficient tractor in the writer's experience allows only 6 brake hp. per plow but can handle only 800 lb. draw-bar pull or 4800 lb. for six plows at 1.7 m.p.h. Where this tractor is operated in 1200 lb. soil, it immediately plows very shallow or drops down to four plows.

Allowing a brake M. E. P. of 85 lb. per sq. in. as a working pressure and a piston speed of 1000 ft. per min. as a high working average, and figuring a tractor speed of 200 ft. per min. we then have a ratio of 5-1 for piston speed to tractor speed and our equation for draw-bar pull figured from the bore would be as follows:

$$\text{D.B.} = \frac{0.7852\ B^{2} \times \text{M.E.P.}\ Ps \times E}{100\ Ts} \qquad (10)$$

In which D.B. = Tractor draw-bar pull.
M.E.P. = Average working pressure on piston.
B = Bore of engine in inches.
Ps = Piston speed.
$E = \dfrac{\text{Tractive Hp.}}{\text{Brake Hp.}}$
Ts = Tractor speed in ft. per min.

This formula points out the desirability of high working pressure in the cylinder, higher piston speeds and the influence of tractor efficiency and design on the size of the engine. It also calls strong attention to the fact that the high tractor speeds mean great cylinder size.

Inserting in equation (10) the various values ascribed above we simply with E = 70 per cent to

$$B = \sqrt{\frac{\text{D. B.}}{234}} \qquad (11)$$

and with an efficiency of 60 per cent

$$B' = \sqrt{\frac{\text{D. B.}}{194}} \qquad (12)$$

We have seen that it requires 1200 lb. maximum draw-bar pull efficiency and design on the size of the engine. It also calls strong attention for each plow. If we desire to know the bore of a four-cylinder engine necessary to pull the plows under the average conditions at 2¼ m.p.h., we substitute the 1200 lb. value in the equation (11) as follows:

$$B = \sqrt{\frac{3600}{234}} = 3.9$$

with an efficiency of 60 per cent

$$B = \sqrt{\frac{3600}{194}} = 4.3$$

The most frequently used engine for a three-plow tractor has a 4.25-in. bore. Tractor engine speeds have been determined mostly by what experience has shown to give endurance. Investigation has proven that the bore seems to have quite an influence on speeds, as well as the development of the art. The following formula expresses the speed of tractor engines in terms of the bore:

$$S = \sqrt{\frac{3{,}000{,}000}{0.04545\ B^{2}}} \qquad (13)$$

In which S = Revolutions per minute.
3,000,000 = A variable depending on manufacturer or development of the art.
0.04545 = Constant.
B = Bore in inches.

The formula holds good for 3¼-in. bore to the very largest sizes, even 9-in.

It is obvious that the factor 3,000,000 cannot hold for all engines of any manufacture, but it gives merely an average.

Life of Engine Parts

The piston speed of 1000 ft. per min. is higher than the old line manufacturers use, their practice being to limit piston speed to 800 ft. per min. While this most certainly results in longer life it is doubtful if this low figure is necessary with the efficient engines of to-day. The piston speed does not in itself determine the life of the engine parts. The engine endurance is more dependent on the square of the r.p.m., weight of reciprocating parts and above all on the efficiency of cooling and lubrication.

Tractor Applicable to Stationary Work

Engines on tractors are used for stationary work, such as running a grain separator, etc. The following formula is derived from service conditions:

$$D = 17\ C \qquad (14)$$

in which D = Displacement of the engine in cubic inches.
C = Size of cylinder on separator.

This assumes power feeds and wind stacker, or what is known as modern attachments on the separator.

General Conclusions

Within the scope of a paper it would be impossible to go very deeply into the science of internal combustion engineering. What has been written has been merely the attempts to answer in a general way the common daily questions that an engineer is called on to answer.

The writer has come to look on the building of engines from the following standpoints:

1—To generate quickly and to utilize all the heat that is possible to produce power.
2—To eliminate the greater part of the heat so as not to interfere with practical working conditions of the structures.
3—To maintain lubrication, an art not generally understood, the development of which is but beginning, and yet the art that makes engines possible.
4—To produce an engine which will not tear itself to pieces, or, in other words, will endure its own stresses, both dynamic and thermal.
5—To make such liberal allowances in design that engines will operate in spite of their neglected upkeep.
6—To get more out of given displacement by increasing the working mean effective pressure and to improve the details, so higher engine speeds can be used without reducing the life of a motor or satisfactory service.

This constitutes ideal progress and is the only way progress can be made.

Temperature Control Will Be Elaborate

(*Continued from page 479*)

Temperature	Expansion
150 deg.	0.101 in.
160 deg.	0.202 in.
170 deg.	0.250 in.
175 deg.	0.250 in.
200 deg.	0.254 in.

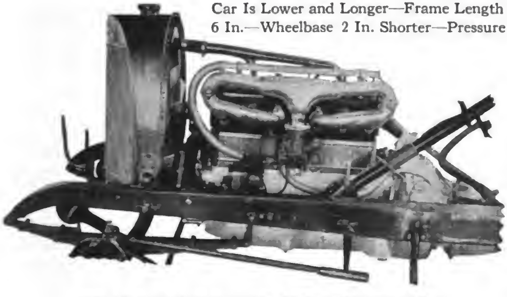
He said that he had tried running at boiling point and found the revolutions increased 150 per minute, while the power went up also, but piston expansion caused a drop again after a short period of running. Regarding the mechanical power of the thermostat unit it was as follows:

Temperature	Pressure Exerted, lb.
70 deg.	Closed
90 deg.	1
110 deg.	2.5
130 deg.	3.5
170 deg.	9.5
190 deg.	14.5
190 deg.	21.6

Concerning the effect of the thermostat he tried taking a car from a room at 60 deg. and starting out in weather 8 deg. above. With the thermostat the carbureter was operating properly after 2.9 miles running with the water temperature in the jackets at 110. The same experiment was made without the thermostat and the carbureter was still popping back and misbehaving after 12 miles running.

Aluminum Alloy Pistons in Singer

Car Is Lower and Longer—Frame Length Increased 6 In.—Wheelbase 2 In. Shorter—Pressure Oil Feed



Intake side of the 4 by 5½-in. six-cylinder engine used in the new Singer

ALUMINUM alloy pistons are the most important innovation on the Singer six for 1917. This car, which sells for $3,500, is entering its third year of production with very few changes of a fundamental nature. There are, however, a number of detail improvements which have rendered the car, as a whole, lower, of slightly better characteristics at high speed, and more nearly perfect in suspension and control.

Car Is Longer and Lower

Magnalite has been selected as the material to supplant the cast-iron formerly used in the pistons. The only other engine change is in the oiling system, which heretofore has fed lubricant to the connecting-rod bearings by splash. In the new cars pressure feed, acting at 30 lb. per sq. in., sends the oil positively to the required spots. This has, of course, necessitated a new oil pump.

Structurally, the Singer car is longer and lower, although the wheelbase is shorter. This condition is obtained by an increase in the length of the frame of 6 in. The wheelbase is now 136 in., however, instead of 138 in., giving a greater over-all length on a shorter supporting span. The prime reason for the change in frame length is in a new type of gasoline tank which, instead of being cylindrical, is now of rectangular section. The cylindrical tank was used because it conformed to the turned-over frame-ends which formed the rear tire support. Since a spindle is now being mounted to carry two extra wire wheels, it is not necessary now to curve the frame over, and hence the new form of tank and longer frame.

This increase in frame length has effects which are not confined to the gasoline tank, in that more room has been secured in the body because of the extra supporting surface which is now possible beneath the sills. Not only is the body more roomy in a lengthwise direction, but the rear seat is also wider, having been increased from 45 in. to 47 in. The body is more comfortable also because of deeper upholstery, which is now 10 in., and, instead of tufting, French plating is used in its place. As far as decoration and conveniences go, the body is improved, particularly in the fitting of a mahogany case in the rear cowl behind the front seats.

Throughout the chassis there are several spots which have been improved in detail. The rear springs, for instance, are now flatter under load than they were formerly. In fact, with a fully loaded car springs should be horizontal, and the feature of this which is important to the driver is that the radius of oscillation of the spring is such that the results on the brake linkage are at a minimum; that is, there is no tendency to bind the brakes owing to spring oscillation because of the minimum projected length of the spring variation. The flatter springs, combined with lower bodies, make the entire car 3 in. lower than it was a year ago.

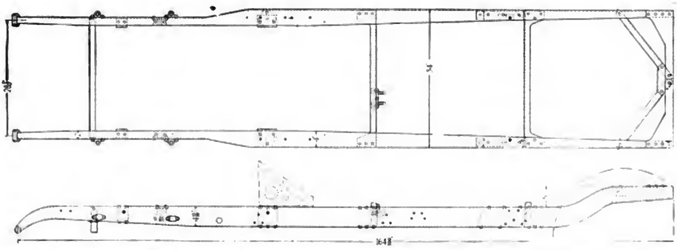
Front Spring Mounting Changed

In the front springs there has been an alteration in mounting. These are parallel to the center line of the car, but are tilted in their own vertical planes so that the forward end of the spring is lower than the rear. This has been done owing to the belief of the engineering department that the shocks are better absorbed in this way. The front spring horn has been made steadier and of greater bearing space to compensate for this change. In addition, the Timken axle, which is used in front, is now the heavy-duty design with full bearing support.

While the torque rod made up of welded Shelby tubing with cross members forming virtual webs is still employed, it is 8 in. shorter. This change has been accomplished by moving the front cross member which carries the support for the forward termination of the torque arm, back a corresponding distance. The result is that owing to the decreased length the torque rod is more rigid. Another change in the rear linkage is in the braking system which used to run continuously from the

Features of Singer Six

Engine	Six-Cylinder
Bore and Stroke	4 by 5½ in.
Formula Hp.	50
Oil Feed	Pressure
Clutch	Dry Plate
Gearset	Four-Speed
Wheelbase	136 in.
Electric System	Westinghouse
Upholstery	10 in.



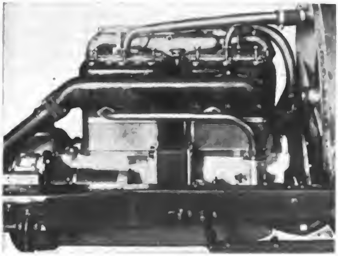
The Singer frame layout is very rigid, the 5-in. channels being well provided with cross members which stiffen it against racking stresses

operating levers back to the brakes. It has now been broken in two, giving a double reduction.

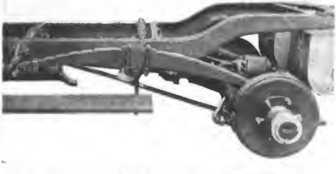
Clutch Easy to Operate

As regards control, the changes are only in detail. There is a longer clutch pedal which has increased the leverage to such an extent that a person standing beside the chassis has no trouble in disengaging the clutch with the hand. The steering gear has been changed and is now a Gemmer.

Fitted to the engine there are three attachments which are innovations for the 1917 model. These are a Rayfield carbureter, a Klaxon horn and a four-bladed cast aluminum fan. The carbureter formerly used was abandoned owing to its difficulty of adjustment, and the simpler Rayfield substituted. As with the other type, this is distinguished by its full hot-water and hot-air vaporizing means.



Exhaust side of the engine used in the Singer six chassis



Cantilever rear spring on Singer chassis. This is flatter under load than previous models, making riding easier and also aiding in giving the car a low appearance

The Singer power plant is made up of a specially-built Herschell-Spillman engine, a dry plate clutch and a four-speed gearset with direct drive on fourth. While the engine is rated at 50 hp., it has developed in excess of 100 hp. at more than 2000 r. p. m., and with the aluminum alloy pistons there has been an increase in power output due to a higher maximum speed. Probably the most notable point of the power plant is the unique system of manifolding. It is to this that a large part of the power and flexibility is credited. The intake manifold has a sort of ram's horn effect, taking the gases from the carbureter, carrying them upward to the branches of a Y-shaped water-jacketed pipe, from where each branch divides into a loop to the three cylinders. This is clearly shown in the accompanying illustration of the intake side of the engine. While this manifold seems long, it will be noted that throughout a large part of its length it is heated, and, furthermore, it is of large diameter and has no sharp turns. It is stated that a marked gain in volumetric efficiency has been obtained due to this intake system.

Dual Exhaust Manifold

On the exhaust side there is a dual manifold in which each set of three cylinders is taken care of independently, thus avoiding conflicting or overlapping exhaust. The manifold itself is in one piece, but there is a wall between, which separates the flow from each block of three cylinders. The timing is arranged so that the exhaust of two cylinders are never open at the same time.

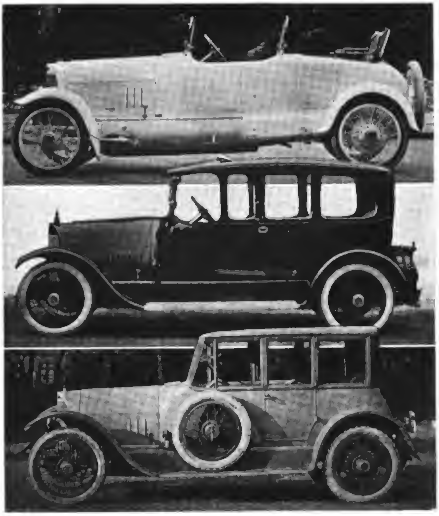
The engine dimensions are 4 by 5½. The cylinders are T-head, cast in threes, with integral waterjacket spaces closed by caps on the top. The manifolds are separate. The aluminum alloy pistons deliver the power to I-beam connecting-rods of forged steel. Both sets of valves are thoroughly inclosed, giving a clean exterior. The carbureter and magneto are mounted on the left, the latter being a Bosch high-tension instrument with the wire leads carried in conduits to the spark plugs. On the right side is mounted the electric generator and water pump, and also the starting motor. The generator and pump are carried on the same shaft, while the starting motor engages with the flywheel at the rear right of the engine.

Besides the ignition system, the remainder of the electrical equipment is Westinghouse. There is a two-unit starting and lighting system operated on the single-wire system, and the storage battery is a Willard.

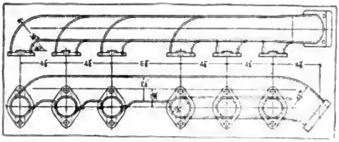
In the new oiling system the gear pump is driven off the camshaft, and the oil reservoir is in the bottom of the crankcase. The oil is fed under pressure to the main bearings and through the hollow crankshaft to the remaining bearings under pressure. Under ordinary running the oil feed is up to 30 lb. per sq. in., but this will vary according to the work performed by the engine. The oil is recirculated and screened on its course through the lubricating system.

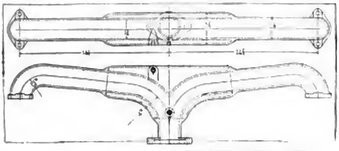
Power is transmitted from the motor to the gearset through a dry plate clutch consisting of steel disks faced with fiber. The clutch is held engaged by a double concentric helical spring, and although this spring is of sufficient strength to hold the car and to guard against slippage on acceleration, the disengagement can be affected by remarkably light pressure on the clutch pedal. This clutch is in a unit with the four-speed gearbox, which is featured by the mounting of the shafting on Timken roller bearings. The shifter mechanism is conventional with the lever mounted on the cover of the gearbox and operating on a ball joint.

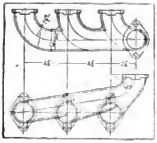
Two Spicer universals are used in delivering the car to the rear axle, which is a Timken floating design. The drive is taken through the cantilever rear springs, but the torque is taken care of by a special member assembled and welded together in the triangular form of Shelby steel tubing. The rear axle gears are spiral bevel and provide a ratio on fourth speed or direct of 3½ to 1. The wheels are Houk wire and carry 35 by 5 in. tires, which have been continued owing to the remarkably good mileage experienced with this size.



Illustrating some of the body styles mounted on the Singer chassis







Above — Exhaust manifold of Singer six, showing partition which separates the two cylinder sets

Below—Intake manifold, showing waterjackets

Right—Portion of intake manifold which bolts to cylinders

One of the noteworthy features of the Singer construction is in the rigidity of its frame layout. As is conventional practice, the individual members are of channel section with a 5-in. depth of web and 4-in. flanges. The frame is amply provided with cross members, which stiffen it against racking stresses. The cross members are fitted with large gusset plates which give them a capability of withstanding distorting tendencies.

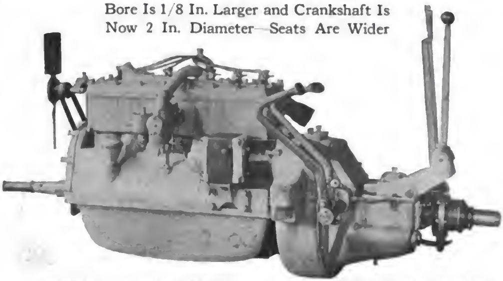
As would naturally be expected with a chassis of this price, the equipment is of the best. The radiator is a V-shape of exceptional size and capacity, and throughout the actual fittings are large and sturdy. The top is a one-man design provided with Jiffy side curtains, and connects with a special built-in ventilating windshield. The car also has a Warner 100-mile speedometer fitted with an electric light, Klaxon horn, 8-day keyless clock, electric trouble lamp with extension cord, tools, jack, power-driven tire pump, etc.

Standard Bodies Made

While the major percentage of bodies for the Singer cars are custom built, the concern is marketing standard roadster, touring and closed bodies. The standard touring design is a seven-passenger type with the Belgian double cowl. The extra seats fold into the backs of the front seats, and above them is located the mahogany cabinet which is an innovation this season. This is made of inlaid wood and is ornamental as well as of practical utility. Any color that is desired will be given the body, so that the purchaser is allowed a very wide latitude in making his selection. The chassis alone sells for $3,000.

New Glide Roomier and More Powerful

Bore Is 1/8 In. Larger and Crankshaft Is Now 2 In. Diameter—Seats Are Wider



Left side of the six-cylinder 3⅛ by 5-in. power plant used in the 1917 Glide, showing the mounting of the carbureter and the starting motor

NO changes of any consequence have been made in the Glide line for 1917. The light 6-40 car is continued with refinements and no additions have been made by the manufacturer, the Bartholomew Co., Peoria, Ill. In general, the changes which have been made in the car are such as to render it more powerful, more roomy and to increase the factor of safety. There have also been a few alterations which would tend toward making the car more nearly silent.

Probably the most notable change is in the engine where the bore has been increased from 3 to 3⅛ in. Another change in the engine is in the crankshaft which has been rendered more rigid by increasing the diameter to 2 in. instead of 1¾ in. Another change in the engine which would tend to make it noiseless is in the use of a Fabroil gear on the end of the camshaft.

While the mechanical changes noted have the most to do with the performance of the car it is also altered to some degree in appearance. One of the improvements is in the rounded cowl which takes away the square effect at the windshield and the latter is especially built to conform with the rounded shape of the cowl and fits exactly to its curvature.

As far as comfort features are concerned a conspicuous feature is the width of the rear seat which is now 47 in. and will accommodate three adults very comfortably. The springs have been lengthened both front and rear giving an easier suspension, the dimensions being now 38 and 54 in. respectively. In general, all the parts and accessory equipment made by specialists have been retained. This includes Westinghouse lighting and starting, Rayfield carbureter, Brown-Lipe three-speed gearset, Spicer universals, etc.

While only one chassis model is marketed the body line is quite complete as the car will be furnished in the regular touring models and with a detachable sedan top if desired. There is also a four-passenger close-coupled roadster in the process of production in which particular attention is stated by the makers to have been paid to the comfort of the occupants of the rear compartment. For instance, by a special arrangement of the footboard in the rear, the passengers have as much room with their feet as those in the front.

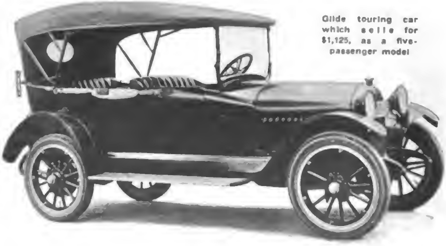
All the improvements in the body can really be summed up in the words, increased roominess. The 47-in. seat is 5 in. wider than in the 1916 car. The front seat is 1⅛ in. wider than previously. The windshield is 1¼ in. wider and 1½ in. higher besides the alteration in curving it to conform to the shape of the cowl. The top is also new, being a five-bow design with bare top holders and having the rear curtain fitted around the corners of the body to exclude dust. It is fastened to the back of the body by German silver molding.

A unit power plant is employed having block cylinders and three-point suspension. The six cylinders have a bore of 3⅛ and a stroke of 5 in. and are of L-head form with the valves on the right. This is a Rutenber product designed particularly for the Bartholomew company, and is known as model 25.

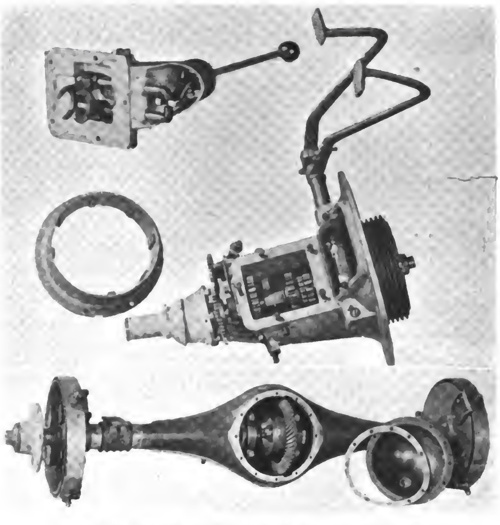
Three Piston Rings

The pistons are cast iron and are fitted with three separate rings. Two of these are close to the top and the third just beneath the wristpin boss. The wristpin is secured in the boss by a set screw and engages through a bronze bushing with the drop-forged I-beam connecting-rod.

The 2-in. crankshaft is a forging, as is also the camshaft which has a diameter of 1⅛ in. with the cams integral. The shafts are hardened and ground and are carried on plain bearings at the center and front and in an S. K. F. double row self-aligning bearing at the rear. Mushroom type flat



Glide touring car which sells for $1,125, as a five-passenger model



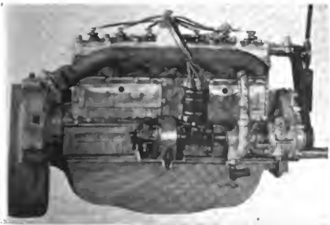
Details of the three-speed gearset and floating axle used in the 1917 Glide

followers take the valve drive. These are offset 1/16 in. to distribute the wear. The valves are made in two parts with alloy steel stems and carbon steel heads. The diameter in the clear is 1 5/16 in. and the lift is 5/16. One of the features of the valve construction is that the brackets, together with the entire lifter mechanism, can be taken from the engine without disturbing the camshaft. This is done by removing the cover plate and stud nuts and then turning the starting crank until the valves are at their lowest level.

Standard timing is used with the intake valve opening at 15 deg. after top center and closing 50 deg. before bottom center. The exhaust valve opens 45 deg. before bottom center and closes 10 deg. after top center. The compression of the engine is 75 lb. absolute.

Lubrication is by accommodation pressure and splash feed with a 1½ gal. reservoir in the bottom pan. From this the oil is drawn by a plunger pump which is driven by an eccentric off the camshaft. There are direct leads from the pump to the main bearings which thus receive a supply of oil under pressure. The other leads go direct to the crankcase where the oil is led to splash troughs placed beneath each connecting-rod throw. Provision is made for the mounting of an oil pressure gage and this may be regulated by an adjustable relief valve.

Complete Westinghouse equipment is used throughout, even to the fitting of an ammeter and voltage regulator. It is a two-unit layout with a reversible switch which alters the direction of current flow automatically so that the contact points of the breaker box are prevented from pitting. For engagement with the flywheel a Bendix gear is used. The battery is a Willard of 80 amp. hr. capacity. Two sets of bulbs are provided in the headlights and there is also a dash light which can be employed as a portable lamp by means of a 12-ft. extension cord.



Right side of Glide six engine, showing the generator and ignition distributer mounting

Gasoline is fed by means of the Stewart-Warner vacuum system which is mounted beneath the hood and operates in connection with a 16-gal. tank at the rear of the frame. Carbureter is a Rayfield and is provided with an efficient choking device which renders it unnecessary to prime the engine through the petcocks even in the coldest weather.

From the engine the power is taken by a dry multiple disk clutch having twelve steel plates. Six of these are faced with Raybestos. The selective gearbox is Brown-Lipe, mounted in an aluminum case, to cut down weight. From this the drive passes through a Spicer universal joint which is dustproof and self-lubricating. The propeller shaft is hollow, having a tubular section and taking the drive directly to the pinion shaft upon which is mounted the spiral bevel pinion. This transmits the power to the floating axle shafts through the Brown-Lipe differential. Two sets of brakes with 14-in. drums having a face width of 2 in. are bolted to the rear wheels. Wheelbase is 119 in.

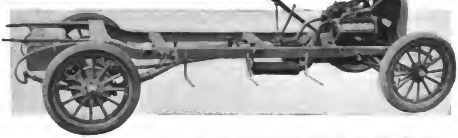
Hotchkiss Drive Used

Hotchkiss drive is used as both the propulsion and torque strains are absorbed in the springs. This is in conformity with the policy to be noted throughout in keeping the car as light as possible. The tire sizes are 34 by 4.

At the price, $1,125, full equipment is included. The price mentioned is for the five-passenger body. A detachable sedan top can be had for $200 additional.

Yale Eight in Production

New Seven-Passenger Car Is Mounted on Chassis Made Up of Standard Units



Chassis of the Yale eight, showing three-quarter elliptic type of rear springs, fuel tank mounting and installation of unit power plant in the frame

THE Yale Eight, which is produced by the Saginaw Motor Car Co., Saginaw, Mich., is characterized by the use of standardized products throughout. For the present it will be supplied only in seven-passenger form at $1,350, though the addition of a Winter top is contemplated. The standard color is ivory white for the body with black fenders and trim. Yale blue and black is an optional finish furnished without extra cost.

The engine used in the new car is built by the Saginaw company and adheres to standard practice in design, having its 3⅛ by 4½-in. L-head cylinders cast in two blocks of four each. Formula horsepower is 31.25. The carbureter is a Rayfield. The Remy ignition unit is acessibly mounted directly at the front of the V. The electric lighting and starting system is a two-unit outfit and the battery is a Willard.

Thermo-Syphon Cooling

Lubrication is primarily by force feed with auxiliary oiling by splash. Cooling is by thermo-syphon. The clutch is a multiple disk type transmitting power through a Muncie three-speed selective gearset in unit with the motor. Hotchkiss drive is a feature.

The chassis has a 126-in. wheelbase and 34 by 4-in. tires are used, with non-skid in the rear. Axles are Timken and steering is Lavine.

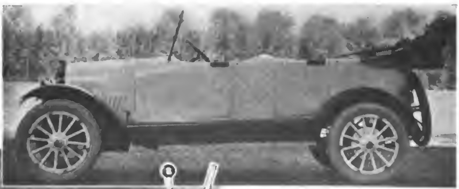
Wind Resistance Minimized

The attempt to reduce wind resistance to the minimum is apparent in the body design. The hood is tapered to blend well with the rather deep cowl and the sides are perfectly smooth. The windshield is smartly raked. There is a cowl at the back of the driver's seat which serves to house the auxiliary seats. All doors are fitted with pockets. The upholstery is leather and the backs of the seats have been moulded to fit the backs of the occupants.

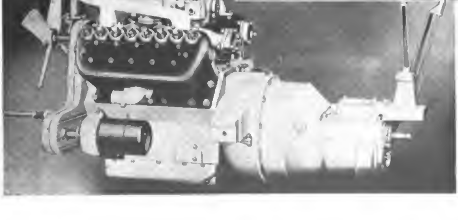
Comfort an Aim

Great care has been taken to insure excellent riding qualities, and to this end the weight has been proportioned over front and rear axles only after long experiment. The spring suspension is normal in front, but in the rear there is modification of the three-quarter elliptic idea, which, however, does not appear unusual. The springs are 56 in. long.

The Saginaw Motor Car Co. has recently purchased the plant of the American Electric Wheel Co., which will be used to facilitate production. The E. B. Sutton Sales Co. has taken over the entire distribution of the Saginaw company. Headquarters have been established at the factory.



The eight-cylinder, seven-passenger Yale touring car which is now going through production. It has a 126-in. wheelbase, three-speed selective gearset and uses 34 by 4-in. tires. Cooling is by thermo-syphon and Hotchkiss drive is a feature. With complete equipment the car sells for $1,350



Yale eight-cylinder unit power plant. It has a bore of 3⅛ in. and a stroke of 4½, the formula horsepower rating being 31.25. The generator mounting is shown, carbureter and ignition units being carried in the V between the cylinder blocks

Burford Truck in 2 and 4-Ton Models

Internal Gear Drive Used on Smaller and Worm Replaces Chain on Larger of New Vehicles

TWO models, a 2-ton and a 4-ton, will compose the line of the Burford Motor Truck Co., Fremont, Ohio, for 1917. The internal-gear drive is used on the smaller chassis and a worm axle on the larger, the former being a continuation of last year's practice and the latter a change from the chain drive employed previously.

Engines Are Similar

The engines used are similar on both models, though different in size and in the fact that the smaller has block cylinders while the larger has pair castings. Dimensions are 3¾ by 5½ in. for the 2-ton and 4½ by 6¾ in. for the larger model.

Lubrication has been cared for particularly, oil being forced to the main crankshaft bearings by a plunger pump, and also supplied to dip troughs for the connecting- rods. Oil pump and strainer gauze are both very easily removable.

On the side of the cylinders remote from the camshaft there is a front end gear which drives the water pump, and the Eisemann magneto is coupled to the water pump shaft by a universal joint. The pulley for the fan belt is set on the same line, just in front of the water pump, keeping the belt high up and so well protected from the destructive action of oil and water.

Difference in Gearsets

On the 2-ton model the flywheel is contained in a bell housing which incloses the leather-faced cone clutch and supports the three-speed gearset, but the 4-ton type has a separate gearbox mounted independently and giving four speeds. This large gearset is of rugged construction, having gears 1½ in. wide with a 5-7 pitch, which makes for great tooth strength. Driveshafts and transmission gears are all chrome-nickel steel.

Strength in frame and springs is obtained by the use of high-quality steel and ample proportions. Radius rods are employed on the 4-ton model, but the smaller truck has Hotchkiss drive, the springs taking both torque and load. There is plenty of load space, the 2-ton being obtainable with either 132-in. or 144-in. wheelbase, and the 4-ton with a wheelbase of 175 in. Throughout both chassis a number of New Departure ball and Bower roller bearings are used.

Brakes Differ

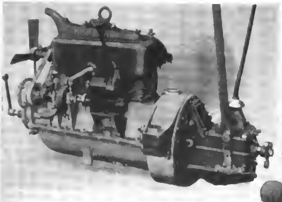
There is a little difference in the brake equipment, the smaller having the conventional expanding brakes in the wheel drums, but the emergency brake acts on a drum attached to the bevel pinion shaft. This axle is made in the Burford plant. The 4-ton has a Sheldon axle, and uses Sheldon double expanding brakes.

Special Bodies Made

Tires are 36 by 3½ on the 2-ton, single in front and dual rear, while the 4-ton has 36 by 5 in., similarly disposed. The smaller chassis lists at $2,250 without body or cab, the latter costing $50 extra, and the 4-ton chassis sells for $3,600. Bodies of any kind can be supplied on special order. A foredoor cab can be supplied at an extra cost of $50.

Both models are electrically lighted, employing Willard storage batteries of the 6-volt, 80 amp.-hr. type. Each model also comes complete with horn, jack and tool kit.

The steering gears are of the conventional worm-and-nut type, with an 18-in. wheel on the 2-tonner and a 22-in. wheel on the 4-tonner. Right drive is adhered to in both models.



Upper — Two-ton Burford model with open body. Left — Power plant of smaller model. Below—Side view of the 4-ton chassis, showing fuel tank mounting

Colorado To Have 45,000 Cars

Secretary of State Estimates Registration Increase of 50 Per Cent Before End of 1916—Over 200 Manufacturers Represented—Analysis by Makes

By H. G. Hedden

DENVER, COL., Sept. 16—Secretary of State Ramer estimates that automobile and motor truck registration in Colorado will pass the 45,000 mark before the close of the year 1916. During the first 6 months of the year 36,231 cars and trucks were recorded, representing the products of over 200 manufacturers. This is a gain of 14,405 cars or 66 per cent over the 21,826 registered during the same period in 1916. When the 45,000 mark is passed the increase over last year will be over 50 per cent. Mr. Ramer estimates that the 40,000 mark was passed early this month, which registration means one motor vehicle for every 20 of Colorado's 800,000 population. This estimate is based upon partial returns received for July and August, upon the calls from County clerks for more license tags and the continued heavy sales reported by State distributors of cars.

$150,000 in Fees

Receipts from motor vehicle license fees in Colorado for 1916 will total between $150,000 and $175,000. No count has been made thus far, however, and the gain will depend upon the ratio of high-power cars. The license fees are $2.50, $5 and $10, for up to 20 hp., 21 to 40, and above 40, respectively. Inasmuch as the Fords, which pay only $2.50, represent 43 per cent of the total for the first half of this year, as against 34 per cent for the same period last year, it will be seen that the gain in receipts can hardly keep pace with the gain in number of cars registered.

The registration shows the following division of cars, according to class and horsepower:

	Denver	Outside	Total
Gasoline passenger cars up to 25 hp.	4,912	15,762	20,674
Gasoline passenger cars above 25 hp.	4,153	8,368	12,521
Gasoline trucks	440	181	621
Electric passenger cars	471	82	553
Electric trucks	67	6	73
Stanley steamers	65	75	140
Dealers' cars, unclassified	270	1,309	1,579
San Miguel County, unclassified	...	70	70

This shows a comparative ratio of approximately 24 per cent for Denver and 76 per cent for the outside counties in the low-power class gasoline passenger cars, with 33 per cent for Denver and 67 per cent for the outside territory in the class above 25 hp.

15,727 Fords Registered

An analysis by make of all the registrations available to date in Colorado shows that there are 15,727 Fords on record,

Analysis of Colorado Registrations By Make and Type

GASOLINE PASSENGER CARS

Make	Denver	Outside	Total
*Ford	2,494	12,233	15,727
*Overland	659	2,267	2,926
*Buick	437	1,932	2,369
*Studebaker, E. M. F. and Flanders	477	1,372	1,850
*Maxwell	524	1,172	1,707
Dodge	239	783	1,022
Cadillac	254	492	847
Chalmers	248	406	654
Chevrolet and Monroe	162	404	566
Reo	120	420	560
Metz	148	307	455
Hupmobile	111	244	255
Hudson	143	184	227
Saxon	62	249	311
Oakland	57	227	284
Franklin	120	126	246
Oldsmobile	105	122	227
Grant	56	152	208
Paige	49	156	205
Cartercar	23	155	178
*Packard	99	77	176
*Pierce	116	46	162
*Jeffery and Rambler	45	110	155
Case	23	114	134
*Velie	28	95	133
Abbott	60	62	122
Mitchell	58	74	132
Haynes	61	60	121
Apperson	50	64	114
*††White	36	66	102
Dort	11	89	100
Inter-State	50	50	100
Regal	22	77	99
Chandler	25	68	93
Stevens-Duryea	60	29	89
Cole	42	42	84
Columbus	71	17	88
Brush	18	63	81
Everitt	52	27	79
Michigan	15	55	70
Kissel	38	31	69
Winton	40	25	65
Jackson	23	39	62
Briscoe	14	45	59
Moon	12	44	56
Peerless	21	20	41
National	23	25	48
Thomas	31	16	47
King	21	24	45
Krit	13	27	40
Dorris	28	11	39
Marion	23	16	29
R. C. H.	17	21	38
Pullman	7	29	36
Scripps-Booth	16	18	34
Detroiter	11	21	32
*Locomobile	18	12	30
Stoddard-Dayton	29	1	30
Pathfinder	13	15	28
Empire	10	16	26
Imperial	4	20	24
Stearns	18	6	24
Elmore	11	9	20
Pope-Hartford	9	11	20
Auburn	0	19	19
Colburn	12	7	19
Pilot	8	10	18
Marmon	10	7	17
Premier	10	7	17
Henderson	10	5	15
American	8	6	14
Crow	5	9	14
Lambert	0	14	14
Cunningham	12	0	12
Hollier	7	5	12
Marathon	6	6	12
Westcott	5	7	12
Allen	0	10	10
Great Smith	0	10	10
Pratt-Elkhart	0	10	10
Smith	10	0	10
Continental	7	1	8
Little	6	2	8
Monarch	8	0	8
Renault	8	0	8
*Alco	5	2	7
Bergdoll	5	1	6
Imp	0	6	6
Moline	0	6	6
Petrel	0	6	6
Sears-Roebuck	0	6	6
Speedwell	0	6	6
Wayne	0	6	6
Welch	0	6	6
Capitol	5	0	5
Gleason	0	5	5
Parry	0	5	5
Warren	0	5	5
Glide	0	4	4
Jones	0	4	4
*Schacht	0	4	4
Stutz	4	0	4
Total	9,161	25,439	34,598

GASOLINE TRUCKS

Make	Denver	Outside	Total
I. H. C.	27	66	93
Chase	27	29	56
Commerce	14	6	20
**G. M. C.	18	12	30
Hercules	6	12	18
Rapid	9	7	16
Federal	12	3	15
Columbia	4	5	9
Denby	5	4	9
Mack	5	4	9
Autocar	5	3	8
Brockway	8	0	8
Garford	7	1	8
Kelly	8	0	8
Wichita	0	7	7
Little Giant	4	2	6
Sampson	6	0	6
Wilcox	6	0	6
Randolph	0	4	4
Total	171	165	325

ELECTRIC VEHICLES

Make	Denver	Outside	Total
*Baker	104	20	134
Fritchle	118	14	132
Detroit	64	22	86
Ohio	55	6	61
*Waverly	29	6	45
Rauch & Lang	29	9	38
Columbia	25	2	27
Hupp-Yeats	11	9	20
Studebaker	18	0	18
†General Vehicle	16	0	16
Babcock	5	3	8
Woods	0	6	6
Flanders	4	0	4
Total	479	117	142

STEAM CARS

Make	Denver	Outside	Total
Stanley	65	75	140

MISCELLANEOUS

Make	Denver	Outside	Total
Various makes	169	145	214
Grand total	10,045	25,921	35,893

NOTE:—*Includes trucks. **Includes electric trucks. †Trucks. ††Includes trucks and steam passenger cars.

Overland holding second place with 2926, Buick third with 2369 and Maxwell fourth with 1707. Of the Fords 3494 are registered in Denver and 12,233 in the rest of the State. There are 659 Overlands in Denver and 2267 outside the city. Denver has 437 Buicks as compared with 1932 for the balance of the commonwealth and 534 Maxwells as against 1173 outside.

These four cars held the first four places last year, but Overland is now credited with second position, which was held by Buick last year.

Of the total of 35,893 registrations available when the analysis by make was undertaken this week, 34,598 were gasoline passenger cars, 335 gasoline trucks, 142 electric vehicles, including passenger cars and trucks, 140 steam machines and 314 miscellaneous. The latter being those whose make and type were not apparent from the registration records. The tabulation herewith shows the number of each make registered in Denver and the rest of the State, the number in each county being given in the second table. The county registration is not entirely complete but approximates the correct figures very closely.

Increased Gains Each Year

A study of the registrations in Colorado for the past three years brings out strikingly the tremendous increases made each year.

To the 1913 registration of 13,624 cars, 1914 added 4809 cars, or an increase of 35 per cent, while 1915 showed a gain of 9821 cars, or 53 per cent, over 1914, and this year promises a gain of 15,000 to 18,000 cars, or more than 50 per cent over last year.

The record for the lone carless county is still held by Dolores County, located in the extreme southwestern corner of the State, highly mountainous, thinly settled and with few roads.

REGISTRATION BY COUNTIES

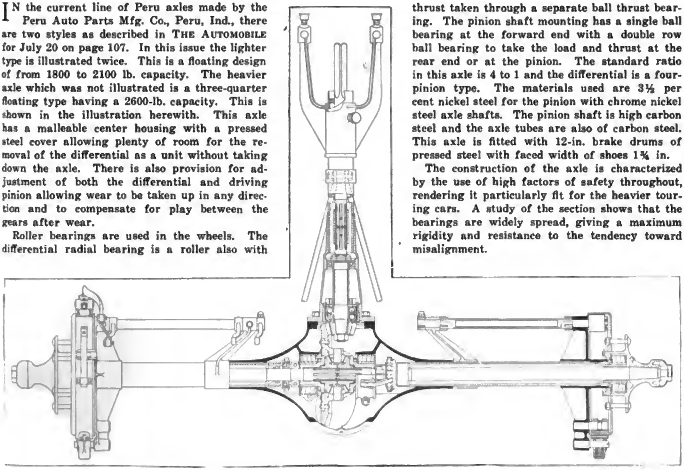
County	Cars		
Denver	10,378	Saguache	229
Weld	2,811	Alamosa	222
El Paso	2,680	Crowley	192
Boulder	1,989	Baca	186
Pueblo	1,984	Sedgwick	181
Larimer	1,960	Douglas	179
Otero	913	Conejos	167
Las Animas	862	Routt	164
Prowers	775	Cheyenne	139
Morgan	747	Lake	136
Yuma	736	Kiowa	124
Logan	694	Rio Blanco	109
Fremont	616	Gunnison	107
Mesa	545	Park	106
Jefferson	539	Montezuma	93
Arapahoe	512	Ouray	93
Delta	497	Costilla	92
Rio Grande	490	Eagle	92
Washington	478	Moffat	90
Montrose	451	Jackson	87
Kit Carson	384	Clear Creek	79
Teller	376	San Miguel	70
Lincoln	367	Pitkin	64
Bent	365	Archuleta	57
Garfield	356	Grand	57
Phillips	346	Custer	53
Chaffee	339	Summit	40
Huerfano	318	Gilpin	34
Adams	304	Mineral	26
Elbert	298	San Juan	16
La Plata	244	Hinsdale	3
		Dolores	No report

Peru 2600-Lb. Axle with Malleable Housing

IN the current line of Peru axles made by the Peru Auto Parts Mfg. Co., Peru, Ind., there are two styles as described in THE AUTOMOBILE for July 20 on page 107. In this issue the lighter type is illustrated twice. This is a floating design of from 1800 to 2100 lb. capacity. The heavier axle which was not illustrated is a three-quarter floating type having a 2600-lb. capacity. This is shown in the illustration herewith. This axle has a malleable center housing with a pressed steel cover allowing plenty of room for the removal of the differential as a unit without taking down the axle. There is also provision for adjustment of both the differential and driving pinion allowing wear to be taken up in any direction and to compensate for play between the gears after wear.

Roller bearings are used in the wheels. The differential radial bearing is a roller also with thrust taken through a separate ball thrust bearing. The pinion shaft mounting has a single ball bearing at the forward end with a double row ball bearing to take the load and thrust at the rear end or at the pinion. The standard ratio in this axle is 4 to 1 and the differential is a four-pinion type. The materials used are 3½ per cent nickel steel for the pinion with chrome nickel steel axle shafts. The pinion shaft is high carbon steel and the axle tubes are also of carbon steel. This axle is fitted with 12-in. brake drums of pressed steel with faced width of shoes 1¾ in.

The construction of the axle is characterized by the use of high factors of safety throughout, rendering it particularly fit for the heavier touring cars. A study of the section shows that the bearings are widely spread, giving a maximum rigidity and resistance to the tendency toward misalignment.



Section through the Peru 2600-lb. axle, which is a three-quarter floating type

Glimpses of Ower
Tour Throug

Over Fifty Men Gue
tion Tour Through Pic

A brief stop at one of the many beautiful points along the Connecticut River in Vermont, where the river winds between the sloping hillsides

The famous horseshoe on Mohawk Trail ascending the mountain between North Adams and Greenfield

Above — Along one of the good stretches of road on the main highway between Boston and Bretton Woods

Right—An example of the roads construction found in Massachusetts

Magnetic Cars on 5-Day New England

R. M. Owen on Invita-
sque Mountain Sections

Owen tourists rolling along roads in New Hampshire which represent the ideal for automobile drivers

Where over fifty Owen tourists spent the night—at Profile House in the White Mountains

Above—Another view in the Vermont section of the Connecticut Valley along the highway to the White Mountains

Left—The eleven Owen-Magnetic cars on the tour on New York highways north of New York City

Liberty Production on Quantity Basis

In Half Year of Company's Existence Scientific Plant Has Been Developed and Sales Approach $5,000,000

AN excellent example of the rapidity of industrial organization and immediate launching into manufacturing activity which is characteristic of the automobile industry, is the progress made in 6 months by the Liberty Motor Car Co., Detroit, Mich. This company, though incorporated only last February, already has a scientifically laid out factory and has been turning out cars in quantity for 2 months. The merchandising side of the business has kept pace with the manufacturing end and sales of the new Liberty six are approaching the $5,000,000 mark, distributing representation having been secured in practically all the leading cities of the country.

The first Liberty car was on the road in April. The factory buildings formerly occupied by the R-C-H Corp. were secured and remodeled to suit the new conditions. New buildings were constructed and old ones rearranged; and equipment to care for modern progressive assembly seemed veritably to be in the plant over night, so industriously did the entire organization work.

By July 4, all was ready; materials having been purchased and delivered, and everything in order. According to a prearranged schedule, cars bearing the Liberty name were being produced long before the end of July, and in presentable quantity.

Ideal Assembly Plant

The buildings are one story and spacious so as to make an ideal assembly plant. Progressive assembly, following a chain system that is slightly modified to meet the needs of the concern, is used. A moderately inclined track has been built down the center of the largest of the group of buildings, this track being about 275 ft. long. At the starting point it is elevated about 1½ ft. above the floor, and at the finish end it slopes down to floor level. The object of this very slight incline is to make it very easy to move the cars along after each operation. A slight push moves the vehicle without effort, and gets away from the necessity of a power conveyor of any sort. Further, the elevating of the track makes it more comfortable for the men, who can work standing at normal height without platforms or falsework. This results in higher speed and, consequently, greater production.

The Assembly Circle

About thirty cars can be accomodated by this assembly track at one time, and the chassis parts are stored on either side of the track. Beginning at the opposite end from the start of the inclined final assembly track, the frames commence their journey through the frame and spring assembly departments and wind up at the chassis paint. Simultaneously in another building, the unit power plants are assembled and prepared for the block test. After passing this examination, the motors go to a position beside the track from which they can advantageously be assembled to the chassis. Thus, beginning at one end, a swing in a complete circle is accomplished, and when discharged from the main line, the completed cars are road-tested and then driven 100 ft. to the long loading platform.

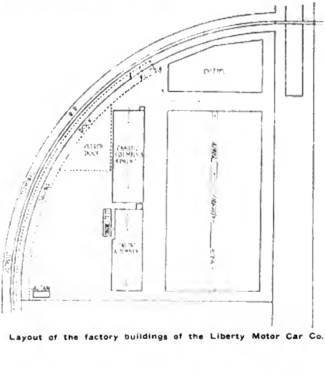
This summary of operations will show that Liberty has laid out its plant scientifically, and in accord with the best experience in building cars rapidly and substantially. It shows that entering into the manufacture of automobiles to-day is no venture for a weak organization, but that brains and experience, backed up by a reasonable amount of money, can succeed even against the great handicap of going into a field of manufacture that is now most keenly competitive.

15.4% of N. Y., N. J. and Pa. Roads Are Bituminous

ROADS treated with bituminous preparations constituted 15.4 per cent of the highways in the three middle Atlantic States, New York, New Jersey and Pennsylvania, in 1914, as compared with 1 per cent in the same States in 1909. This improvement is entirely due to the increase in the use of automobiles and trucks, according to the third 5-yearly study of road mileage, road types and highway finances in these States reported by the Office of Public Roads and Rural Engineering in department bulletin No. 386.

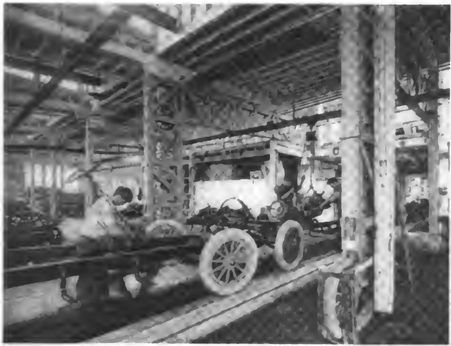
Approximately 9 per cent of the improved road mileage of the three commonwealths is now surfaced with concrete brick or other of the more substantial materials used in road construction as compared with 1 per cent in 1909. In 1904, when the first road study was made neither bituminous nor the more substantial roads were found, untreated macadam and gravel roads predominating. Roads of the unimproved type were reduced from a percentage of 51 to only 39.3 in the 5 years from 1909 to 1914.

On Jan. 1, 1915, the three States mentioned had roads totaling 185,770.84 miles, Pennsylvania having approximately 91,500, New York 79,000 and New Jersey 15,000, these statistics being exclusive of practically all streets in incorporated cities and towns. New Jersey added 17 per cent of surfaced roads in the 5 years from 1909 to 1914, Pennsylvania 7 per cent and New York 3.5 per cent.

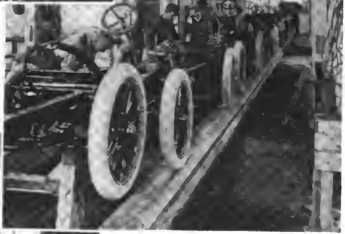


Layout of the factory buildings of the Liberty Motor Car Co.

Progressive Assembly System Speeds Up Liberty Production



At the start of the assembly line in the factory of the Liberty Motor Car Co., Detroit, Mich. The chassis run down the track accumulating their component parts as they progress. Note the engine being lifted into place at the right and the overhead runways delivering wheels from the stockroom



A vista down the inclined assembly track, showing the chain of Liberty six chassis gradually growing into complete cars fitted with bodies, tops, etc., at the farther end of the line

Above—Part of the engine testing room at the plant of the Liberty Motor Car Co., showing the type of testing blocks used and the cooling water connections employed for the test runs

Right—A view of the engine assembly department at the Liberty factory, showing how each engine is mounted on a rolling stand, rendering it easy to move it from point to point as needed. Note the gearbox, bell housing and control assemblies in the background waiting to be mounted

The Rostrum

Why Four-Cylinder Pistons Are Larger

EDITOR THE AUTOMOBILE:—Will you kindly tell me why the piston is larger in four-cylinder cars than in six and eight-cylinder cars and why they will develop more power than a four-cylinder?

Harrodsburg, N. Y. H. G. S.

—The reason that the bore of the four-cylinder motor is in general less than that of six and other multi-cylinder engines, is simply because of the fact that more power than is necessary for the car is not desired. Every cylinder assembly acts as a separate engine in supplying power. The same amount of power can be obtained from six smaller cylinders as from four larger ones. Hence, to secure the desired amount of power with four cylinders, it is natural that each of the cylinders should be made larger.

Looking at the matter from another angle, that of piston displacement, it will be remembered that displacement is a direct factor of power. If a displacement of, say, 300 cu. in is desired and if enough power will be secured from this displacement, it would be obtained by using four cylinders of 75 cu. in. displacement or six cylinders each having 50 cu. in. displacement. Naturally, the pistons for the 75 cu. in. cylinder will be larger than those for the 50 cu. in.

Naphthalene Not Recommended in Fuel

Editor THE AUTOMOBILE:—Please advise me as to the use of naphthalin or naphthalene with flakes in gasoline for increasing mileage and as a carbon remover. It has been recommended to use a teaspoonful to every 5 gal. of gasoline and I am told that this substance is put up under many names and sold for that purpose. Please advise me as to its qualities and how it works and if you advise me to use same, giving reasons for your conclusions.

Fall River, Mass. E. J. D.

—The use of naphthalene or, as it is commonly known, camphor, is not recommended in gasoline. As a matter of fact it will deposit as much carbon as it will remove and will result in a sooted engine. A simple experiment which will readily show you the carbon-forming tendencies of camphor may be performed by simply holding a camphor or mothball over an open flame. The carbon will leave the camphor in long string-like formations.

Compression Bad on Three Cylinders

Editor THE AUTOMOBILE:—I have a 1916 model 43 Oldsmobile which has poor compression on all but one cylinder when cold, but does not show so much difference when hot. I have had the head off and ground the valves. I think it is in the gasket joint as the old gasket showed black carbon streaks, especially between cylinders. It hasn't the power it should have and has only run 2200 miles. Would it help any to put in two gaskets and shellac all sides of them, or is there anything else that will make it hold?

2—I am getting about 15 miles per gallon of gas. How many should I get with a new Stromberg carbureter?

3—Will this carbureter increase the power acceleration speed and make starting easy?

4—Is the Fracto a good device for headlights? Will it prevent glare and give good driving light?

Kenosha, Wis. T. A. F.

—Since the old gasket shows carbon streaks it is quite likely that you are right in your surmise that the car is losing power due to leakage. The new gaskets well shellaced may remedy the trouble. Also, go over the intake manifold connections very carefully and be sure that there are no air leaks around these.

2—It is pretty difficult to state what mileage you should get to a gallon of fuel without knowing how fast you drive, what load is carried in the car and other details which have their effect. In all probability, however, 15 miles to a gallon is a good average consumption.

3—In fixing upon a carbureter for their car the Oldsmobile engineers have no doubt taken all the matters which you mention into consideration, and while it is within the realms of possibility that you may secure a gain by changing your carbureter there is no reason why you should not get satisfactory service from the one which is on your car.

4—THE AUTOMOBILE has never had an opportunity to test out this device, but no doubt you could secure a demonstration from its manufacturers.

Redesigning Michigan Radiator

Editor THE AUTOMOBILE:—I desire to make a change in the radiator design of my 1913 Michigan car. I have designed one of the following dimensions and would like to know if it is large enough to cool a four-cylinder motor of 4¼ by 5¼ bore and stroke. The height is 25¾, width 22½ and 3¾ in. through cross section. The design is the same as the 1916 Mercer.

Pittsburgh, Pa. N. H.

—The radiator you mention would be sufficient, provided you have good pump delivery. The cooling of an engine does not depend so much on mere capacity of the radiator as it does on the volume of water that is handled in a unit of time. The purpose of the radiator is to carry a given number of B.T.U. from the engine in a given amount of time. Generally, the thermal units lost through the cooling water are about 35 per cent of the heat taken into the engine with the fuel. Under abnormal conditions, such as climbing long hills, this percentage will increase to as high as 50 and if the cooling chamber is too small it will go above the capacity of the radiator, causing overheating.

The method of determining the amount of heat carried off by the radiator is to first measure the quantity of water in cubic feet passing through the cooling system in 1 min. The temperature of the entering water is then subtracted from the temperature of the water leaving the jackets, giving the range between extreme temperatures. This temprature range is multiplied by the cubic feet of water passing through in a minute to determine the B.T.U. per minute. Knowing the calorific value of the fuel, the theoretical radiator can be readily determined in the manner suggested.

As a matter of fact manufacturers of cars do not determine their radiator size so much by the theoretical calculation as they do from a knowledge of what can be expected from a given size engine, a pre-determined pump and a known radiator size. This is a matter of development and even calculating on this basis errors have been made which have resulted in a necessary increase of radiating surface. Radiators of different forms have different efficiencies and the mere capacity and dimensions of a radiator do not tell anything unless its efficiency is known. You do not mention the form of radiator you are employing, but, assuming it to be of the honeycomb type, it will be sufficiently large if the pump capacity is great enough to keep the radiator filled with rapidly flowing water at low engine speeds.

Even the fan design is of greatest importance in cooling. A fan that is sufficient for one radiator will be bad for another. The reason for this lies largely in the shape of the radiator, which may be such that it does not permit the fan to draw through all sections. A simple test can be made to determine the area of draw of the fan by placing small pieces of paper against the outside of the radiator when the engine is turning over at idling speed, and seeing if the paper remains drawn against the face of the radiator. It very often happens that certain areas of a radiator have a positive back current or eddy passing through them which instead of pulling cold air from the exterior of the car gives a flow of warm air which has been heated from its confinement beneath the hood.

Information on Stearns-Knight Engine

Editor THE AUTOMOBILE:—What are the most difficult features to overcome in the manufacture of a Knight eight engine? What part of the motor would be most likely to give trouble in operation, that is, in ordinary touring service?

2—Kindly illustrate the Stearns-Knight six engine in THE AUTOMOBILE. I wish to know the distance from driveshaft of transmission to front of engine, also width from tip to tip of arms that the engine is hung on, and distance between front and rear arms.

Swan Lake, Miss. H. D.

—In manufacture there is little doubt but that the grinding work is the thing which must be watched closest on a Knight eight-cylinder engine. This must be accurate for all cylinders. As for trouble in operation, there is no reason why any part should be conspicuous in this respect after manufacture has been carefully carried out.

2—The Stearns-Knight engine is shown in section in Fig. 1. The distance from the driveshaft of the gearset to the front of the motor is 39⅝ in. The width of the arms in front is 20¾ in. and at the rear 26⅞ in. The distance between the front and rear arms is $18\frac{13}{16}$ in.

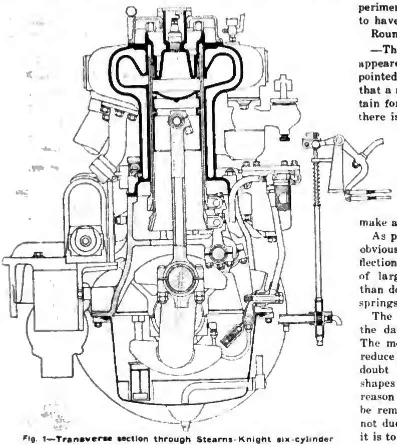


Fig. 1—Transverse section through Stearns-Knight six-cylinder engine

Believes in Full Elliptic Springs

Editor THE AUTOMOBILE:—There has been much speculation as to the most comfortable spring for the automobile, but strange to say, the full elliptic spring is not mentioned. This is probably due to the fact that so few have had the experience of riding in cars fitted with these springs, as the conventional half and three-quarter elliptic are mostly used.

I claim that there is nothing that can approach the full elliptic both front and rear, with the front spring slightly tilted backward, as in the Franklin, to receive road shocks. This may seem a broad assertion, but it is conceded by everyone who has had experience. There may be a few very heavy, high-priced cars fitted with deep cushions and shock absorbers that give comparative ease, but I am speaking of the ordinary size car. This also holds true with respect to pleasure wagons as long ago the elliptic spring was used. Then came the desire for something better and all sorts of springs were tried, but they soon disappeared and the elliptic came back and stayed because the principle was right.

I would like to ask why manufacturers of automobiles do not use them more. Is it the cost, or the difficulty of attachment on a steel chassis, or both? Is it the appearance that is objectionable? There are thousands of cars made to-day that meet every requirement except riding qualities, and we believe it would be a big selling factor if some other leading makers would adopt the elliptic spring. It sold my car after trying a score of others and after using it 5 years and experimenting with different models it would seem a hardship to have to change.

Round Top, N. Y. J. W. F.

—The point you bring up is covered in an article which appeared in THE AUTOMOBILE for Sept. 7, page 393. As pointed out in this article, by A. Ludlow Clayden, the idea that a spring had some special virtue because it was of a certain form has been pretty well exploded. On the other hand, there is no doubt that certain forms of springs have certain advantages but no spring is easy riding simply because of its external shape. It is rather in the development of its individual units that the secret of its success will be found alive. The length of the spring and the number of leaves have a marked effect regardless of the shape, and the ratio of sprung to unsprung weight of the chassis will also make a material difference.

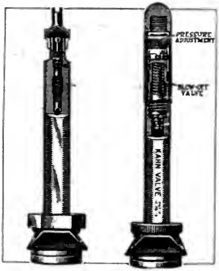
As pointed out, in the article mentioned, a long spring will obviously alter its curvature less for a given amount of deflection than a shorter spring, since the tangent to the circle of large diameter more closely approaches the periphery than does a tangent to a small circle. Fiber stresses on long springs are also less than on shorter ones.

The number of leaves in a spring has a direct effect upon the damping action which reduces the bounce or rebound. The more leaves there are the greater the surface area to reduce the throwing action of the spring by friction. No doubt manufacturers find that the chassis weights and shapes suit certain springs better than others, and for this reason a variation will be found in external shape, but it must be remembered that where easy suspension is obtained it is not due so much to the virtue of the shape of the spring as it is to the scientific way in which the spring design has been worked out.

ACCESSORIES

Armstrong Inner Tubes

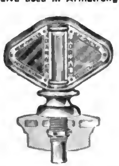
LONGER tube life and greater comfort and convenience for the car owner are the features claimed for Armstrong inner tubes, due to the use of the Kahn automatic valve. As shown in the accompanying illustration, this valve differs from the conventional type in that it is provided with a blow-off valve and a pressure adjustment so that when the desired degree of inflation has been reached no more air enters the tire and the whistling of the blow-off indicates the fact. The valve also differs from the usual type in that the valve stem fits through a hole in the body of the valve instead of having the stem screwed into the body of the valve. The operation of the pressure adjustment is clearly shown in the illustration. The inner tubes themselves are laminated, being made of heavy red rubber. The manufacturer controls the Kahn valve construction and states that the tubes sell at standard prices.—Armstrong Rubber Co., Inc., 118-122 Adams Street, Newark, N. J.



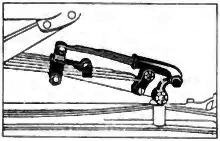
Left—Conventional tire valve. Right—Kahn valve used in Armstrong tubes

Heat-Ometer

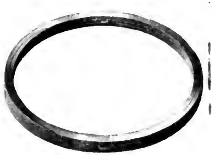
This instrument is intended to apprise the driver of an overheated condition of his engine. As shown in the illustration, it is inserted through a hole drilled in the radiator cap and held in position by a lock nut. A diamond-shaped frame holds the glass indicator tube containing a sensitive liquid, which is pink at normal temperatures, but turns a deep purple when a dangerous degree of heat is reached. The frame at each side of the tube is paneled, one side being enameled pink and the other purple, enabling the driver to check the engine temperature by comparison. The standard size sells for $3, and the junior for $2.—Heat-Ometer Co., Inc., 1 Broadway, New York City.



Heat-Ometer, a radiator gage



Duplex cantilever spring for Fords



Hi-Comp piston ring composed of two eccentric interlocking rings

United Stands and Cranes

The Every-Way engine stand supports the engine while being overhauled, allowing the workmen to reach every portion with ease. The base is composed of two steel Z-bars bolted to the floor. To this two uprights of cast iron are fastened, cored hollow, with vertical slots in which the two steel brace clamping nuts travel. One upright is rigidly bolted to the base, the other being adjustable to take any width of engine, and is locked in a manner similar to the tail stock of a lathe. The supporting arms for the engine are steel angles, with numerous holes bored both in the horizontal and vertical sides. These angles are pivoted in the center to the two uprights. The engine is bolted to the angles by the same supporting brackets that support it in the chassis. The height to the top of the angles from the floor is 30 in.; length of angles, 42 in.; length of base, 52 in.; weight, 185 lb.

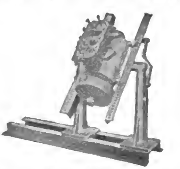
A portable, hand operated floor crane, having the high lift and deep overhang required in repair shop work, is also manufactured. A heavy cast iron base, mounted on truck wheels, supports the light steel superstructure carrying the hook, chain and drum. Because of the heavy base and light upper structure, the center of gravity is very low, preventing top-heaviness, and permitting a high lift. The U-shape of the base allows the crane to be placed in any desired position about the car, and is narrow enough to pass between the wheels of a car. Prices, No. 66, 1-ton, 6 ft. 6 in. lift, 33 in. overhang, $64; No. 76, 1-ton, 7 ft. lift, 33 in. overhang, $66; No. 80, 2-ton, 7 ft. 6 in. lift, 36 in. overhang, $82. —United Engine & Mfg. Co., Hanover, Pa.

Hi-Comp Piston Rings

Two eccentric interlocking rings combine to form a single concentric ring. The rings are made from soft gray iron and ground together. It is not necessary to take the rings apart, as they expand sufficiently to fit over the piston. The design of the ring is said to give an equal expansive power on all parts of the cylinder, even though worn out of round. Two rings only are required for each piston. Price, all sizes to 5½ in., $1.65 each.—Continental Piston Ring Co., Memphis, Tenn.

Duplex Cantilever Springs

A new type of auxiliary spring for Ford cars has been developed in the Duplex cantilever spring. Upon each end of front and rear springs one of the Duplex springs is fastened, the upper end being secured at about half the distance to the middle of the standard Ford spring; the lower end under the front springs is attached to the present Ford perch and the front spring suspended



Every-Way engine stand, showing mounting of engine from the Duplex spring, producing a cantilever action. This is said to eliminate side-sway and promote easy riding of the body. The rear Duplex springs attach to the perch in the same manner and add 5 in. to the span of the ordinary Ford spring. A set costs $15. —Duplex Cantilever Spring Co., Chicago, Ill.

Wegman Automatic Decarbonizer

This device supplies moisture to the intake manifold. Water is taken from the waterjacket above the carbureter down through tubing to the intake manifold, where it is carried with the mixture to the cylinders. The amount flowing is regulated by a needle valve used in connection with a sight feed glass on the tubing, and the supply is automatically shut off when the engine stops by a ball check valve. The device may be attached to any make motor by drilling and tapping two ⅛-in. standard pipe tap holes—one in the intake manifold and one in the waterjacket. It is claimed that the water is turned to superheated steam by the explosion temperature, which removes the carbon and increases the power of the engine. Price, $5.—Manufacturers Distributing Co., 400 Publicity Bldg., St. Louis, Mo.

Morton Front Wheel Brakes

Designed to supply a front wheel braking system for most makes of cars, no alterations to the car are required in the installation, and the brakes are said not to interfere with the proper operation of any part of the car. The brakes are of the expanding type, and so connected that the braking effort is applied to all four wheels at once. Quickness in stopping and prevention of side sliding or skidding are the advantages claimed for these brakes.—Morton Brake Co., 45 S. Tenth Street, Minneapolis, Minn.

Comet Dash and Trouble Lamp

A combination dash and trouble lamp. On the dash, behind the lamp socket, is an automatic reel carrying 10 ft. of lamp cord. A spring in the rewind reel holds the lamp to the dash as a dash lamp. When used as a trouble lamp, it is freely portable. Price, $5.—Auto Specialty Co., Galesburg, Ill.

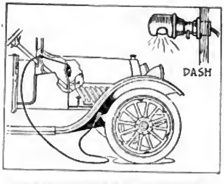
New Greenfield Tap

This tap, styled the "Gun" tap, is so made that it cuts with a shearing action, curling the chips ahead of the cutting edge and preventing clogging. The cutting edges are ground at an angle at the point, permitting the tap to cut freely and make clean, sharp threads. The body of the top has no cutting action, only serving to hold the work true to lead. The taps are made with two or three flutes only, left shallow so that the tap is nearly as strong as the solid stock. It is claimed that chipping is confined to the cutting edge, which may easily be reground. Regrinding may be repeated until only two or three full threads are left, it is said, and will retain its cutting size to that limit.—Greenfield Tap and Die Corp., Greenfield, Mass.

The Morton front-wheel brakes are of the expanding type, and connected with the rear-wheel braking system

Wegman Decarbonizer, which supplies moisture to the intake manifold, draining the water from the waterjacket

The new Greenfield tap



Comet dash and trouble lamp combined

Ventilating Hood Holder

This ventilator is intended to permit the free circulation of air beneath the Ford hood. These holders are substituted for the standard Ford clamps, and allow the hood to be clamped in an elevated position. The forced draft caused by the motion of the car passes over the motor, and escapes at the rear. The running temperature of the engine is lowered, and the performance of the engine is bettered, it is claimed. In cool weather the hood may be locked in the closed position. Price, per set of four, $4.50.—V Air Valve & Mfg. Co., Denver.

M. & E. Metal Shingles

Light, fire and storm-proof metal shingles are made up of copper, tinplate or galvanized iron. Constructed on scientific principles, this shingle can be put on more readily than any other form of metal roofing, it is said. Expansion and contraction are provided for; and the large overlap makes an absolutely tight roof of one-sixth pitch or over. A pleasing appearance, combined with reliability at a moderate cost are the advantages claimed for this type of shingle. Prices, Gothic, 14 by 20 size, 68 shingles per square, $4 painted, $5.75 galvanized.—Merchant & Evans Co., Philadelphia, Pa.

Lally Motor Tread Mill

Power for driving a saw or any machine requiring a power drive may be taken from the rear wheels of a car by the use of this device. It consists of a frame carrying a cross shaft with three pulleys and a jacking device which lifts the car wheels and presses them against the two outer pulleys on the shaft. When the engine is run the shaft is driven and power taken from the middle pulley by a belt. The jacking device is operated by a screw and the tension of the rear tires against the drums may be adjusted.—Lally Commercial Body Co., Everett, Mass.

Ventilating hood holder

THE AUTOMOBILE

PUBLISHED WEEKLY

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Building vs. Assembling

MANY of the manufacturers who commenced their business as chassis assemblers, using stock parts throughout have recently changed their system, and some of them now make all the principal parts of their car. This has come about in two ways. In some cases the manufacturer has enlarged his factory and equipped to make his own parts in the parent plant, as for example the Hudson extension for the making of the Super-six engine. Others have bought up parts producing plants, as for example the complete absorption of various parts makers into the General Motors organization.

It is interesting to speculate as to the ultimate effect, and the reasons for the observed changes in policy. No doubt several automobile assemblers have been driven to making their own parts by failure of their original supplier to make deliveries on schedule. In other words the condition of the materials market has reacted via the parts maker and has mildly frightened the automobile producer. In other cases the desire for a distinctive design has been the mainspring.

Meanwhile the parts makers have all improved their plants and nearly all have enlarged; they have better facilities than ever before, so when the cost of raw material comes down again, the parts makers will be able to offer very tempting prices indeed. In conditions of enormous demand and high material cost it is less easy for the parts specialist to hold his own against the car builder with a fairly large output, than it is in normal times.

No other industry owes so much to detail specialists as does the automobile industry and it is hard to believe that the parts makers will not be able to retain their position as conditions ease, so any great extension of individual manufacture of complete cars is unlikely. In another 3 or 4 years we ought, however, to be able to see clearly when it does pay to make parts specially for one car and when it does not, a matter which is still debatable.

"Tanks"

THE huge war machines which have just made their appearance as participators in the British advance on the Somme seem, from the cabled reports, to be exactly what so many war story writers of the past have imagined. H. G. Wells pictured just such machines 10 or 12 years ago in one of his novels, and the impregnable motor car has been used by many another author of fiction.

A Matter of Cost

That such machines were possible, that even bigger ones could be built, has been known to automobile engineers for a long time. What has hitherto been lacking was sufficient funds to enable sufficient experiment to be made. No doubt these British crawling forts are the product of many experiments and many failures, and they have been built with no regard whatever to their cost.

Of course we are still ignorant as to the exact size and detail of these machines, probably very little detail will be available till the end of the war. One certain thing, however, is that they must be vastly heavier than the biggest caterpillar tractor ever built in America if their power of crumbling down houses and breaking off trees is as great as the daily press reports state, even though it is reported that the chassis used in their construction are of American manufacture.

There is no fundamental reason why one could not build a land traveling machine as big as an ocean liner if there was any purpose to be served, just as there is no doubt an automobile could be built that would do 200 miles an hour, if the incentive were sufficient. It is, however, not easy to see how monster land machines could serve any useful purpose in peace time although many other war creations have afterwards found their place in the scheme of things and history may repeat itself once more in this connection.

U. S. Troop Trucks

IT is about time that the United States government tried the motor truck as a means of transporting troops. The reflection of the French success on the Marne should be found in this country. Recently two regiments were transported 200 miles in 32 hours, using 132 trucks. This is only a start. Let us try longer distances with more men.

Open Price Value in Co-operation

Price Publicity and Profit-Sharing High Lights of Babson Conference

WELLESLEY HILLS, MASS., Sept. 15—The Third Babson Conference on Co-operation was held here Wednesday, Thursday and to-day. Its object is the promotion of co-operative competition, which includes the open price and profit-sharing.

The open price is the most radical part of the plan, for profit-sharing is quite extensively practised and is generally understood.

The open price means price publicity, and in those associations which are founded on this idea the members freely exchange the prices they make on different articles, the bids they submit on contracts, and even the cost of production.

It is opposed to price maintenance and yet it tends to reduce price cutting. The element of futurity is eliminated. No member tells what his price shall be, but, instead, tells what it has been or is now. This prevents unscrupulous buyers from playing one manufacturer against the other and beating down prices by false statements. But there is nothing to prevent any man making any price he wishes. He can sell below cost if he wants to. The big idea is that if all the prices are known to all there will be less tendency to cut ruinously than if all work in the dark and slash dangerously low to make sure of getting the business.

Open-Price Operation

The open-price plan is operated through associations, which exchange the information through a bureau. There are about twenty associations to-day and the plans vary in detail. In some all the data connected with a sale is given—price, customer's name and cost. In others less is given, running down to the price alone.

The open-price part of the conference was devoted principally to an explanation of plans now in effect. The speakers were: D. B. Doremus, Salt Producers' Association; Ernest H. Gaunt, Optical Manufacturers' Association; W. V. Spaulding, Leather Belting Exchange, and H. S. Wales, Pressed Metal Association.

Cost Finding

Another phase of the work of these associations is that of cost finding. Efforts are made to have manufacturers install systems that will tell them the exact cost of the product, which information will be of assistance in making prices. The speakers stated that cost systems disclosed some startling facts to manufacturers.

In the employees' profit-sharing part of the conference three plans were described:

1. Simple share in company's profits. Described by Everett Morse, president Simplex Wire & Cable Co., Cambridge, Mass.

2. Share in profits and stock interest in business. Plan used by Dennison Mfg. Co.; described by Mr. Dennison.

3. Share in profits under fraternal interest of company without interest in company. Plan of Ford Motor Co. Described by Dean S. S. Marquis, head of educational department of the Ford Motor Co.

Times Square Motor Supply Co. Formed with $1,000,000

NEW YORK CITY, Sept. 20—The Times Square Motor Supply Co. has been formed here to take over the business of the Times Square Automobile Co. and all its branches. The new company has $1,000,000 in preferred stock, all of which has been subscribed and 40,000 shares of common of no par value. The stock will be offered on the New York Curb.

All capital will be used in enlarging the business of the company, which plans to establish twenty new stores within 90 days and twenty more before May 1, 1917, making a total of fifty. Accessories will constitute the entire stock, neither new nor used cars being bought or sold.

Officers of the new company are: Morris Froehlich, president; Jesse Froehlich, vice-president; Louis Mansbach, treasurer; and John E. Gores, secretary.

Invents Two-Wheeled Armored Car

AUBURN, ILL., Sept. 16—S. J. Clark, this city, has invented a two-wheeled armored motor car, designed for military use, which he has submitted to the war department at Washington. The car is equipped with a small central wheel in front of the two main wheels. The principal object of the car is to protect men from fire while digging trenches, being easily shifted from point to point. It is also designed for patrol duty, operating under almost any kind of conditions, due to its light weight.

Crowther Chassis on View

ROCHESTER, N. Y., Sept. 15—A chassis has been assembled by the Crowther Motor Co. which incorporates the Duryea roller drive in which the power is applied to the rim of the wheel. This is now on exhibition at the Powers Hotel in this city. It is stated that the company will be soon ready for production in their Rochester plant.

U. S. Caterpillar Battery

Holt Machine Can Pull Big Guns at 3 M. P. H at a Big Saving

NEW YORK CITY, Sept. 20—Considerable excitement has been manifested in the daily press regarding the so-called Tanks or crawling forts in use by the British army. From the information that has leaked through the ever-vigilant censors it would appear that these are a super-developed caterpillar tractor, very possibly of Holt design as far as the chassis is concerned.

The success with which these heavy tractors seem to have been used on the other side lead to the natural question as to what has been done in this country along the same lines, and it is gratifying to note that while the United States has not as yet done anything on the heavily armored tractor very thorough data has been accumulated on the subject of tractor transport for heavy artillery.

It is understood that at the present time there is under process of organization a tractor battery in which an entire regiment with twenty-four heavy field pieces will be drawn by caterpillars. This organization will be ready, it is believed, in about a year and is to be stationed in the Hawaiian Islands. The battery which is to be known as the ninth heavy field artillery will have no horses at all, the caterpillar tractors taking the place of 1000 of these animals. The place of saddle horses will be taken by motor cycles and the reserve ammunition will be carried by motor trucks. It is very probable that this regiment will be equipped with artillery which will correspond to the famous German 42-cent. gun.

Full data as to costs, etc., have been worked out at the experimental station at Fort Sill, Okla., and it is found that in this heavy work the cost of the motor-drawn battery would be about $40,000 less than a horse-drawn one, and the annual saving of pay, clothing, rations and forage would be about $25,000.

A. S. A. E. Members Can Join S. A. E.

NEW YORK CITY, Sept. 20—Members of the American Society of Aeronautic Engineers can become members of the Society of Automobile Engineers without payment of initiation fees, provided these memberships are taken out within 90 days. This announcement was made in THE AUTOMOBILE last week, except that the name of the Aeronautical Society was used in error for the A. S. A. E. and it was stated that annual dues need not be paid. This should have referred to initiation fees.

$500 Electric in Boston?

Battery That Will Recharge and Marked Economy Features of New Car

BOSTON, MASS., Sept. 16—Plans are now under way here to build an electric car with a battery that will recharge itself when running on level ground, and which can run 2 or 3 days without getting a boost. It will run very cheaply, will weigh less than 1500 lb. and will sell in the neighborhood of $500. Plans are under way to place the stock on the market, and the men behind it are all big enough so that their names mean something. The man who has devised the machine has a national reputation in the electrical world, and is connected with the biggest company in the country making electrical apparatus.

An experimental car has been thoroughly tried out and it has proved a success.

More complete details regarding the new car will be available as soon as the manufacturing arrangements are under way.

Lane Trucks Out Soon

KALAMAZOO, MICH., Sept. 16.—The new plant of the Lane Motor Truck Co., Kalamazoo, will be turning out manufactured goods within a short time. M. H. Lane reports that the necessary parts for a large number of trucks have been ordered and that the output will be marketed rapidly as soon as the new factory is ready for the work ahead.

Light Four Tractor Tested

MARION, OHIO, Sept. 16—The Huber Mfg. Co. gave a demonstration of its Light Four tractor on the J. B. Guthery farm, located 2½ miles west of Marion, this week. The tractor pulled three 14-in. plows, plowing at the rate of a little better than 1 acre an hour. The furrow was 9 in. deep.

Bound Brook Oil-less Bearing Co. Adds

BOUND BROOK, N. J., Sept. 16 — The Bound Brook Oil-less Bearing Co., is erecting a re-enforced concrete addition, 50 by 100, to its plant No. 2, to take care of the increased business in Nigrum impregnated wood bearings.

Hench & Drongold to Make Automobile and Truck Bodies and Parts

YORK, PA., Sept. 16 — The Hench & Drongold Co., this city, large manufacturer of garden implements, has entered the automobile field as maker of wood work of all kinds for automobiles and trucks, including bodies and parts of both wood and metal. The company will also build special machinery and do machine and forge work. Special equipment has been installed in the company's large new plant, which covers about 6 acres.

Van Dorn Tool Doubles Capacity

CLEVELAND, OHIO, Sept. 15—The new plant of the Van Dorn Electric Tool Co., located on the heights above Cleveland has doubled the output of the company. The new building is three stories and is of steel, brick and concrete. It is located on a spur of the Cleveland Belt Line.

American Chain Salesmen Inspect New Bridgeport Plant

BRIDGEPORT, CONN., Sept. 15—At a convention of American Chain salesmen held recently, a thorough inspection was made by the men of the new plant which is being erected here. This will double the capacity of the Weed concern, as it includes 50,000 sq. ft. of floorspace. The roof is just being closed on one of a group of six buildings and a duplicate of this five-story building will be completed in 30 days.

Continental Begins Another Addition

MUSKEGON, MICH., Sept. 13—The Continental Motor Co. has begun work on the erection of a new automatic screw machine factory building, which will be one story high and of the saw-tooth roof style. When this building is completed the automatic screw machine department, which is now located on the third floor of the L factory building, will be moved into the new plant.

Kelly-Springfield May Move

AKRON, OHIO, Sept. 18—The Kelly-Springfield Tire Co. is considering the removal of its plant from this city to Cumberland, Md. If moved, the plant will be tripled in capacity. The Akron plant will be sold for, it is expected, $750,000, and negotiations are under way for the donation by Cumberland of $750,000 and a 75-acre site. The company now employs 1500 men, but in Cumberland would have 3000. Kelly-Springfield is paying $4 a share and earning about $12.

Maxwell Assembly Plant for Dallas

DALLAS, TEX., Sept. 13—The Maxwell Motor Car Co., Detroit, Mich., has purchased a site for an assembling plant to be the distributing point for five States. The Dallas plant will be the third of its kind to be erected by the company.

Master Calorite Plugs Adopted by P. O.

HARTFORD, CONN., Sept. 16—The postmaster general has awarded to the Hartford Machine Screw Co., manufacturer of master calorite spark plugs, the contract for the Postal Service.

Waukesha Motor To Expand

Increases Capital from $200,000 to $1,000,000—Adds to Plant Facilities

WAUKESHA, WIS., Sept. 16—The Waukesha Motor Co., Waukesha, Wis., manufacturer of motor car, truck and tractor motors, has increased its capital stock from $200,000 to $1,000,000 to provide for extensions to its plant. Work on a new office building is now under way, and plans are being prepared for large extensions of the machine shop, assembly department, and testing shop. The company has been obliged to decline acceptance of numerous large orders for engines because its facilities already are being pushed to the utmost by the orders now being executed.

Harroun Motors Buys Plant

DETROIT, MICH., Sept. 18—The Harroun Motors Corp., in which Ray Harroun is a principal, has bought the Prouty & Glass Carriage Co. plant at Wayne, and will begin the manufacture of a car designed by Harroun, as announced in THE AUTOMOBILE last week. First models were built in the Dodge Power Building. The car will be sold for less than $600.

Bosch Magneto Co. Adds Again

SPRINGFIELD, MASS., Sept. 16—The recent addition to the local works of the Bosch Magneto Co. is to be further augmented by an addition providing more than 60,000 sq. ft. Ground has already been broken for the new building, and it will be rushed to completion.

The addition is to be a single-story building, with saw-tooth roof providing maximum light and ventilation.

When this second addition has been completed there will have been more than 130,000 sq. ft. added to the Bosch works during 1916.

Maxwell Plant for Dallas

DALLAS, TEX., Sept. 16—The Maxwell Motor Car Co. has purchased a site for an assembly plant here, which will be the distributing point for five States. The plant is the third of its kind in the United States.

Brunswick-Balke Tire Plant Contracts Awarded—Plan Dwellings

MUSKEGON, MICH., Sept. 11—Construction work on the automobile tire factory of the Brunswick Balke-Collender Co. will be started soon, the contract for the building having been awarded. The structure will cost $40,000 to $50,000, and will have 40,000 sq. ft. of floor space. It is to be ready for occupancy within sixty days.

In order to provide for the increase in the number of its employees, the Brunswick company has also contracted for the erection of about thirty double dwellings, to be occupied only by its own workers.

Loewe Is Brunswick-Balke Mgr.

MUSKEGON, MICH., Sept. 18—F. J. Loewe has been appointed general manager of the Brunswick-Balke-Collender Co., billiard and bowling alley fixture maker, which entered the automobile tire manufacturing field last April. For the benefit of its workmen the company has started construction work on a large number of double houses.

Russell Resigns from Bessemer

GROVE CITY, PA., Sept. 16—R. F. Russell has resigned as production engineer of the Bessemer Motor Truck Co. to become identified with the Air Reduction Co. in New York. Mr. Russell has been connected with the Bessemer for the past 3 years.

Taylor Joins Evapco Co.

DETROIT, MICH., Sept. 16—Kirk Taylor has been appointed sales and advertising manager of the Evapco Mfg. Co., this city, succeeding W. O. Seelye. Taylor was formerly assistant manager for the New Era Spring & Specialty Co. The Evapco company hereafter will sell only to jobbers.

Millar, of Auto Parts Mfg. Co., Dies

MILWAUKEE, WIS., Sept. 16—James D. Millar, secretary and treasurer of the Auto Parts Mfg. Co., Milwaukee, died of apoplexy this week, aged 62 years.

Imperial Brass Co. Expands

Will Have 150,000 Sq. Ft. After Additions Are Completed—24 Hr. Schedule

CHICAGO, ILL., Sept. 18—The Imperial Brass Mfg. Co., this city, will begin next week the construction of an addition to its factory which will double its floor space. The present building contains 75,000 sq. ft. and the addition will contain an equal area, giving a total of 150,000 sq. ft. The new foundry space will more than double the present foundry space. Like the present plant, the new building will be of heavy mill construction and will be erected on an adjoining site at Harrison Street and Racine Avenue. Bids are now being taken for the building work. Orders have been placed for the new factory equipment.

The company's plant has been running night and day for several months without doing any war business.

Ford Distributes $850,000

DETROIT, MICH., Sept. 18—The Ford Motor Co. has distributed $850,000 as bonuses among 1399 heads of departments, superintendents, foremen, and other employees, in sums of $100 and up. This is $120,000 greater than the 1915 bonus.

Tobin with Cutting, Armstrong & Smith

DETROIT, MICH., Sept. 16—F. D. Tobin, assistant district manager of the Willard Storage Battery Co., Detroit, has resigned to become affiliated with the Cutting, Armstrong & Smith Sales Co.

Iowa Rubber Plant in Bettendrof

DAVENPORT, IOWA, Sept. 16—The Iowa Rubber Tire Co., recently organized, will locate its plant in Bettendrof, a suburb of Davenport. A tract of 10 acres has been purchased, and an option secured upon an adjacent tract of similar size. It was necessary to locate the plant close to the Mississippi River, as 200,000 gallons of water will be consumed daily in the various processes of manufacturing tires. Ground will be broken on Nov. 1. An initial order for $100,000 worth of machinery has been placed. C. H. Roth, who recently resigned as vice-president of the American Tire and Rubber Co., has arrived in Davenport to take active charge of the department of sales of the new concern.

McQuay-Norris Men Promoted

ST. LOUIS, MO., Sept. 18—The McQuay-Norris Mfg. Co. has made the following promotions in its selling force: Frank J. Stanley of the traveling force is made manager of the Cincinnati branch; Howard W. Sweeney is made manager of the Denver branch.

Stockbridge Heads N. E. Winton

LONDON, ENGLAND, Aug. 26—Ball and Motor Car Co. of Cleveland has sent Frank W. Stockbridge to Boston to become manager of the New England branch on Commonwealth Avenue. He succeeds F. A. Hinchcliffe, who has taken the agency for the Jordan car.

Wizard Parts Co. Formed

BAY CITY, MICH., Sept. 15—The Wizard Auto Parts Mfg. Co. was recently organized here to manufacture a new steering device for Ford and other cars, invented by L. J. Weatherwax. It is said that several automobile manufacturers after having investigated the merit of the new invention have made propositions to Mr. Weatherwax for exclusive rights to use the device. Mr. Weatherwax is president of the company; C. J. Scheurmann is vice-president; F. B. Scheurmann, secretary-treasurer.

Seiberling Field, Akron, Ohio, as it appeared Labor Day on the occasion of the field and track meet held by the Goodyear Tire and Rubber Co. This athletic carnival is said to be the largest ever held by a private corporation

Hydraulic Pfd. Issue $1,000,000

Pressed Steel Co. Plans to Retire Present Issue of $200,000

CLEVELAND, OHIO, Sept. 16—The Hydraulic Pressed Steel Co., this city, has issued $1,000,000 7 per cent cumulative preferred stock, which has been purchased by Borton & Borton. J. H. Foster, vice-president and general manager of the company, states that the new capital will be used in extending and developing the company's business, it being proposed to retire the present preferred issue of $200,000, which is callable at 102½. A sinking fund will be established Jan. 1, 1917, and each year thereafter $50,000 worth of the new stock will be retired. The stock will be callable at 107½. The company will not be sold.

Total net assets of the company will show an excess of three times the new preferred stock issue, and the net quick assets about one and one-half times. The earnings of the company for the past 2 years have averaged four times the dividend requirements of the new preferred issue. The subscription price has not yet been set.

General Bearings Corp. to Take Over Standard Roller

PHILADELPHIA, PA., Sept. 16—The General Bearings Corp. is about to be organized here to take over the business of the Standard Roller Bearing Co., this city, which has been in the hands of receivers for 3 years. No information as to the personnel of the new company is ready for publication, but it was stated that the capital stock will be about $5,000,000.

The receivers, R. S. Woodward, Jr., and S. Laurence Bodine, are preparing their report to be submitted to the United States District Court in this city for approval. In the meantime an application has been made for the renewal of the present license which was granted by the Hess-Bright Corp., holder of the Conrad patents for ball bearings, and which is about to expire. The renewal is being asked for as a matter of protection to the new company and will be considered by the court.

The plans for reorganization, it was said, will allow the present stockholders to participate by paying an assessment of $7.50 on each share of common stock and $15 on each share of preferred.

$40,000 Co. to Make Visible-Measure Gasoline Dispenser

LOUISVILLE, KY., Sept. 16—The Visible Measure Gasoline Dispenser Co. has been incorporated here to manufacture, sell, install, rent and lease the Visible Measure Gasoline Dispenser. The capital stock of the company is $40,000, divided into 4000 shares of $10 each, and the limit of indebtedness which may be incurred is $10,000.

Incorporators and their holdings are: J. Henry Brady, 3000 shares; William A. Earl and William A. Pell, 10 shares each.

Materials Market Holds Steady

NEW YORK CITY, Sept. 20—Tin and cottonseed oil showed the greatest changes in the materials market quotations during the past week. Both were up, cotton seed oil by 58 cents per barrel and tin by 50 cents a 100 lb. Lead also increased so that it has now attained a level of 7 cents per pound. Lard oil left the dollar mark and ascended to $1.08. No drops in prices are to be noted in the quotations.

Calmont Resigns from Jackson

JACKSON, MICH., Sept. 11—G. C. Calmont, has resigned as advertising manager of the Jackson Automobile Co.

Ryan Heads Gibson Branches

INDIANAPOLIS, IND., Sept. 20—The Gibson Co., Indiana Overland distributors, has appointed P. J. Ryan as supervisor of its six branches.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.60	.61	.61	.61	.61	.61	+ .01
Antimony, lb.	.11½	.11½	.11½	.11½	.11½	.11½	...
Beams & Channels, 100 lb.	2.76	2.76	2.76	2.76	2.76	2.76	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28	.28	.28	.28	.28	.28	...
Copper, Lake, lb.	.28	.28	.28	.28	.28	.28	...
Cottonseed Oil, bbl.	9.75	10.10	10.04	10.20	10.25	10.28	+ .58
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.58	.58	.58	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.00	1.00	1.00	1.00	1.00	1.08	+ .08
Lead, 100 lb.	6.70	6.80	6.80	6.90	6.90	7.00	+ .30
Linseed Oil, gal.	.69	.69	.69	.69	.69	.69½	+ .00½
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined, gal.	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River Para, lb.	.72	.72	.72	.72	.72	.72	...
Rubber, Ceylon, First Latex, lb	.58½	.58½	.58½	.60	.60½	.61½	+ .04½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	38.50	38.37½	38.50	38.50	38.50	38.50	+ .50
Tire Scrap, lb.	.05¼	.05¼	.05¼	.05¼	.05¼	.05¼	+ .00¼

Fuller Ouput Worth $700,000

Parts Manufacturing Concern Has Record Year—New Plant Is Planned

KALAMAZOO, MICH., Sept. 12—This has been the biggest year in the history of the Fuller & Sons Mfg. Co. The value of the output of automobile parts for the fiscal year 1916 as given by the officials is $700,000, as compared with $225,000 in 1915 and $75,000 in 1914. The working force, which was about fifty men in 1915, ran up to 225, and even 250 at times, during the present year. By 1918 the concern expects to have a new plant of more than twice the size of its present premises.

Ellis-Smith Replaces Rub-On

BUFFALO, N. Y., Sept. 16—The Ellis-Smith Mfg. Co., Inc., is the new name of the Rub-On Mfg. Co., Inc. The change became effective Sept. 1. The management and sales policy of the company remain the same.

Portage Rubber Raises Dividend to 10 Per Cent

BARBERTON, OHIO, Sept. 16—Directors of the Portage Rubber Co., this city, have placed the stock on a 10 per cent yearly basis by declaring a quarterly dividend for a time of 2½ per cent of the common, payable to stock of record Nov. 3.

Dividends Declared

Gray & Davis, Inc., quarterly dividend of 1¾ per cent on preferred, payable Oct. 1.

Springfield Body Corp., quarterly dividend of 2 per cent on preferred, payable Oct. 1, to stock of record Sept. 21.

Wilson & Co., Inc., quarterly dividend of 1¾ per cent on preferred, payable Oct. 2, to stock of record Sept. 20.

Stutz Motor Car Co., 2½ per cent on common, 1½ per cent on second preferred, and 1¾ per cent on third preferred, payable Oct. 2 to stock of record Sept. 15.

Billings & Spencer Co., Hartford, Conn., quarterly of 2 per cent, and an extra dividend of 3 per cent payable on Oct. 2.

Allis-Chalmers Mfg. Co., quarterly of 1½ per cent on preferred, payable Oct. 16 to stock of record Sept. 30.

Texas Co., quarterly of 2½ per cent, payable Sept. 30 to stock of record Sept. 15.

Saxon Motor Car Corp., quarterly of 1¾ per cent, payable Oct. 2 to stock of record Sept. 29.

G. M. C. Common Up $120 in Week

Market Strong in Many Issues —Chevrolet Increase $18 and Firestone $25

New York City, Sept. 19—General Motors common still remains the feature of the market with a net increase of $120 per share during the last week. This makes a rise of $155 in 3 weeks and is not only a new high mark for the issue itself but sets a record for the New York Stock Exchange, with one exception which is the sale of Northern Pacific at $1,000 per share during the panic of 1901.

Firestone came back during the week. It was off $30 a week ago, but its increase of $25 brings it back to $1,015 bid and $1,030 asked. Another rubber stock to show an advance was Miller which is now up to $265, an increase of $27 a share during the week. The other tire and rubber stocks remained quite firm with little fluctuation as compared with the more active stocks. Chevrolet, which was quite steady last week, took another forward move and increased $18 a share so that the closing price yesterday was $213.

Scripps-Booth Elects Directors

New York City, Sept. 18—The board of directors of the Scripps-Booth Corp., which was recently formed to acquire and operate the Scripps-Booth Co. and the Sterling Motor Co., of Detroit, is made up of the following: C. H. Booth, president; W. H. Little, N. J. Miller, W. L. Scripps, F. J. Sesenbrenner, Alfred P. Sloan, Jr., and T. P. Warner.

Up to the present time the production of Scripps-Booth cars has reached approximately 6000, about one-third of which has been sold in foreign markets.

Saxon and Stutz Stock on 'Change

New York City, Sept. 16—Stocks of the Saxon Motor Car Co., Detroit, Mich., and the Stutz Motor Car Co., Indianapolis, Ind., have been listed on the New York Stock Exchange, and will be traded in in a few days, or as soon as the permanent certificates are ready. The new stock of the General Motors Co. is being actively traded in on the Broad Street curb "when, as and if issued." Since Monday last the stock has advanced some 35 points.

Grant Earns $78,000 in August

Cleveland, Ohio, Sept. 16—Net earnings of the Grant Motor Co. in August amounted to $78,000. This is at the rate of 40 per cent on the common stock after paying the dividend on the preferred.

Gasoline 1 Cent Lower in Ohio

Columbus, Ohio, Sept. 16—The price of gasoline in Columbus and central Ohio territory has been reduced from 22 to 21 cents per gallon. It is expected tbat the price will be still farther reduced in the near future.

Ky. Crops to Boost Car Sales

Corn Yield Expected to Equal 1915 Record—Tobacco and Hay Do Well

Louisville, Ky., Sept. 16—Kentucky automobile manufacturers, distributers, dealers and factory representatives are elated over the latest report of the United States Department of Agriculture, forecasting for the State a corn crop of more than 114,000,000 bushels, which is equal to the crop of 1915, the largest ever raised in the State; a tobacco crop of 472,000,000 lb., which is 115,000,000 lb. larger than the crop of last year, and is a new higb record, and a hay crop of 1,240,000 tons, an increase of 15,000 tons over 1915, and also a new high record. Crops falling short of 1915 include wheat, with an estimated production of 8,190,000 bushels as compared with 9,900,000 bushels in 1915; oats with a yield of 4,540,000 bushels, a decrease of 920,000 bushels from 1915, and apples, with a yield of 2,470,000 barrels as compared with 4,170,000 barrels in 1915. The large crops of corn, tobacco and hay more than offset the decreases in the other crops and the sharply advanced prices for all farm products give the crops of the State a substantially higher value than the crops of 1915.

This means prosperity in the Blue Grass State, and there is no question but what big corn, tobacco and hay crops

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co.	..	..	65½	58	+3
J. I. Case T. M. Co. pfd	78	84	81¼	84	—1¾
Chalmers Motor Co. com	109	111	158	164	+13
Chalmers Motor Co. pfd	96	99	97	100	+2
*Chandler Motor Car Co	..	..	105	†106	—3
Chevrolet Motor Co	..	..	208	213	+18
Fisher Body Corp	..	..	40¼	41	..
Fisk Rubber Co. com	..	..	97	106	—2
Fisk Rubber Co. 1st pfd	..	..	110	114	+3
Fisk Rubber Co. 2d pfd	..	..	101	110	+1
Firestone Tire & Rubber Co. com	525	535	1015	1030	+25
Firestone Tire & Rubber Co. pfd	111	..	110	112	..
*General Motors Co. com	286	290	680	740	+120
*General Motors Co. pfd	114	115	126¼	127	+ ¾
*B. F. Goodrich Co. com	65½	67	72⅛	72½	+ ⅛
*B. F. Goodrich Co. pfd	108	110	113½	113⅞	+ ⅜
Goodyear Tire & Rubber Co. com	295	300	248	252	+1
Goodyear Tire & Rubber Co. pfd	108½	109½	108	109	+ ¾
Grant Motor Car Corp	..	..	7	8	..
Hupp Motor Car Corp. com	..	..	6¼	6¾	+ ¼
Hupp Motor Car Corp. pfd	..	..	80	100	..
International Motor Co. com	29	31	6	10	..
International Motor Co. pfd	61	65	15	20	..
*Kelly-Springfield Tire Co. com	210	213	82⅜	82¾	— ⅞
*Kelly-Springfield Tire Co. 1st pfd	88	90	98	100	—1
*Lee Rubber & Tire Corp	..	..	46	48	—1½
*Maxwell Motor Co. com	45½	47	91¼	91¾	+9⅞
*Maxwell Motor Co. 1st pfd	89	90	85⅝	86¾	+2⅛
*Maxwell Motor Co. 2d pfd	37	38½	55	56	+2½
Miller Rubber Co. com	190	195	250	265	+27
Miller Rubber Co. pfd	107	109	104	106	..
Packard Motor Car Co. com	120	130	164	173	—1
Packard Motor Car Co. pfd	93	94	97	101	..
Paige-Detroit Motor Car Co	..	..	30	34	—23
Peerless Truck & Motor Corp	..	..	26	27	+2½
Portage Rubber Co. com	55	59	160	164	+8
Portage Rubber Co. pfd	93	94	160	165	+10
Regal Motor Car Co. pfd	..	..	17	22	+3
Reo Motor Truck Co	..	17½	43½	44	— ½
Reo Motor Car Co	33	34	43½	44	— ½
Saxon Motor Car Corp	..	..	75	82	+3
Springfield Body Corp. com	..	..	84	89	..
Springfield Body Corp. pfd	..	..	120	130	..
Standard Motor Construction Co	..	..	6	7	..
Stewart-Warner Speed. Corp. com	66½	67½	113	114	—1
Stewart-Warner Speed. Corp. pfd	105	107	..	..	..
*Studebaker Corp. com	128¾	130	129⅝	130¾	+5⅜
*Studebaker Corp. pfd	106	107	109	111	..
Swinehart Tire & Rubber Co	86	90	99	101	+7
United Motors Corp	..	..	66	67	+4⅜
*U. S. Rubber Co. com	51½	53	59½	59⅝	+1½
*U. S. Rubber Co. pfd	104	106	114	115	+2⅜
White Motor Co	110	..	55	55½	+2
*Willys-Overland Co. com	192	194	47⅛	47½	— ⅛
*Willys Overland Co. pfd	105½	108	104¼	105	+1

*At close Sept. 18, 1916—Listed New York Stock Exchange. †Ex.-Div. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co	..	..	39	41½	+2¾
Chalmers Motor Co. com	110	115	165	173	..
Chalmers Motor Co. pfd	97¼	99	..	102	..
Continental Motor Co. com	..	295	38¾	40	+3⅛
Continental Motor Co. pfd	85	90	9½	10½	..
Ford Motor Co. of Canada	..	1535	320	..	+15
General Motors Co. com	285	295	725	..	+80
General Motors Co. pfd	114	118	126	129	..
Maxwell Motor Co. com	44	46	87½	90½	+4
Maxwell Motor Co. 1st pfd	88	90	86	89	+1½
Maxwell Motor Co. 2d pfd	36	39	53	57	+2
Packard Motor Car Co. com	120	130	163	168½	—2
Packard Motor Car Co. pfd	100	..	..	102	..
Paige-Detroit Motor Car Co	..	450	31	34	—18
W. K. Prudden Co	20½	22	41½	..	—2½
Reo Motor Car Co	33¼	34¾	43⅜	45	— ⅜
Reo Motor Truck Co	16¾	17¾	42½	44	—2¼
Studebaker Corp. com	120	125	128½	131½	+6½
Studebaker Corp. pfd	105	109	105	..	..
C. M. Hall Lamp Co	..	..	25½	..	+ ½

INACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Atlas Drop Forge Co	..	31	35	..	..
Kelsey Wheel Co	205	..	55	60	..
Regal Motor Car Co. pfd	..	21	18	..	..

will result in a greater demand for cars. Farmers and people out in the rural districts are buying more machines than ever before.

It is pointed out by local automobile men that in a crop year marked by extreme fickleness of weather, from which the country as a whole has suffered severe losses in the principal crops, Kentucky has been conspicuously fortunate.

Skinner a Manufacturers' Representative

NEW YORK CITY, Sept. 16 — Kenneth Skinner has resigned as secretary of the Micro Piston Ring Co., this city, having sold his interest in the concern. Mr. Skinner has gone into business as a manufacturers' representative under the firm name Auto Appliance Co., 1960 Broadway, where he represents the G. H. Dyer Co., Cambridge, Mass., and the Asbestos & Rubber Works of New Jersey, Camden, N. J. The Auto Appliance Co. is also planning other connections.

Electric Charging Station in Melbourne

MELBOURNE, AUSTRALIA, Aug. 26.—The municipal electric supply department in this city will open a charging station for electric vehicles at its power house on Spencer Street. This station will be open day and night. The cost of current for charging will be 2 cents per unit between the hours of 10 p. m. and 8 a. m., and during other hours will be 3½ cents per unit. A charge of $2.43 per vehicle per week will be made for accommodation.

The absence of electric vehicles from the streets of Melbourne is largely due to the lack of charging stations, and the establishment of the above station will do much to create a demand for American electric vehicles of all kinds.

Barley Cars Painted to Suit Buyer

STREATOR, ILL., Sept. 16—The Barley Automobile Mfg. Co., Streator, has decided to paint all of the cars manufactured in the future in accordance with the wishes of the buyers. A lengthy list of color combinations has been prepared which is submitted to patrons.

Cleveland Dealers to Protect Buyers

CLEVELAND, OHIO, Sept. 16—Cleveland dealers have formed an association for the protection of automobile buyers, offering a uniform service policy. This policy will insure to the purchaser the service to which he is entitled, a strict fulfillment of the manufacturer's guarantee, inspection and adjustment.

Ceylon Import Duty Increased

COLOMBO, CEYLON, Aug. 20—The duty on automobiles, excluding trucks, imported into this country has been increased to 33 1/3 per cent ad valorem, the increase being effective Aug. 2. The former rate on automobiles was 5¼ per cent ad valorem.

May Revive Hoosier 500-Mile

Proposed Increase of Purse to $50,000 May Mean Longer Distance

INDIANAPOLIS, IND., Sept. 16—It is expected that the Indianapolis Speedway will ask a sanction for a race of 500 miles with a purse of $50,000 to be held next Decoration Day. The original speedway contest was for this distance, but it was reduced to 300 because of the seeming unpopularity of the longer event.

Some time ago the speedway managers agreed not to offer more than $100 per mile and since a purse of $50,000 is being considered by the Indianapolis management, it necessarily follows that the distance must be increased if the $100 per mile agreement is to be kept.

22 Entries for Astor Cup

NEW YORK CITY, Sept. 19—Twenty-two entries have been received so far for the Astor Cup Race which will be held on the Sheepshead Bay track on Sept. 30. The entries are:

Car	Driver	Car	Driver
Crawford	Moore	Sunbeam	Christiaens
Crawford	Klein	Sunbeam	Chevrolet
Crawford	Chandler	Deusenberg	Milton
Kleinart	Unnamed	Deusenberg	D'Alene
Delage	Franchi	Mercer	Pullen
Delage	Devigne	Mercer	Ruckstell
Dans L'Argent	Muller	Deusenberg	Buzane
Deusenberg	Devlin	Blue Bird	Unnamed
Peugeot	Resta	K. W. P. Sp.	Packard
Hudson	Vail	Olsen	Unnamed
Adams Sp.	Adams	Olsen	Unnamed

In addition the management expects further entries which will bring the list up to thirty-two.

Speedway Men Meet Sept. 29

NEW YORK CITY, Sept. 18—Representatives of speedways in Tacoma, Indianapolis, Chicago, New York, Cincinnati, Providence, Des Moines, Omaha, Kansas City and Sioux City will meet in this city Sept. 29 to fix the speedway racing dates for 1917. Some of these tracks are represented by three or four men, which brings the gathering up to twenty-five or thirty.

Returned Soldiers to Build Roads

TORONTO, ONT., Sept. 16—The Dominion Military Hospitals Commissions, which met in Toronto, to-day, under the presidency of Senator Lougheed, adopted resolutions advocating the building of a national highway by the Federal Government and the promulgation of a comprehensive land settlement policy for returned soldiers. The first resolution set forth: That as a considerable number of the men who have enlisted and are at present overseas or about to proceed thither, are unskilled laborers for whom it may be difficult to provide employment immediately on their return, the commission advocates the building of a national highway by the Federal Government. It would respectfully submit to the government that such an undertaking would be a work of the greatest value. Among the advantages would be:

1. Temporary employment would be provided for thousands of men who would not otherwise find work.
2. No public would provide so large an amount of employment at so small a capital outlay.
3. The highway would be of immense value as a means for the transit of agricultural and other produce.
4. It would be the means of attracting numbers of tourists, entailing the spending of money within the borders of Canada.
5. It would solve the problem of demobilization, as it would allow of a gradual disbanding of the troops from coast to coast.
6. It would be a most practical memorial to Canada's part in the great war.

Bearings on British Embargo List

LONDON, ENGLAND, Aug. 26—Ball and roller bearings and steel balls and rollers for bearings have been added to the British list of goods the exportation of which is prohibited to all destinations.

Spark plugs have also been included in the embargo list but these are prohibited from being exported to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain and Portugal.

Illinois Dealers Must Use Number Plates on Demonstrators

BLOOMINGTON, ILL., Sept. 16—Illinois automobile dealers must attach a license plate to every car used for demonstrating purposes, or which are otherwise engaged for commercial purposes. This announcement was made by Ben Cochrane, State examiner for chauffeurs who is now going over the State, issuing licenses to all drivers. In some cities, the dealers have purchased one license and utilized but the single plate. The courts have ruled that one license is sufficient but each car must carry a number. The duplicate plates will be furnished by the Secretary of State for their exact cost. Each dealer is being notified of the requirements of the law, and the authorities in each city have been directed to see that all dealers respect it.

400,000 Cars in Iowa?

DES MOINES, IOWA, Sept. 16—Iowa will have 400,000 automobiles, or one for every six persons in the State, according to the prophecy of W. D. Wilwerscheid of St. Paul, Minn., who manufactures automobile number plates. The registration for this year is already 190,000, and the total is expected to exceed 200,000 before the end of the present year.

84,000 See Show at Milwaukee

State Fair Included 202 Gasoline Cars, 2 Electrics and 14 Trucks

MILWAUKEE, WIS., Sept. 16—More people saw the second annual motor show of the Milwaukee Automobile Dealers, Inc., at State Fair park this week than visited the Milwaukee Auditorium show last January. Nearly 84,000 people paid 10 cents to see the Wisconsin State Fair automobile show of 1916. In all, nearly 100,000 people were admitted to the concrete automobile building. The official attendance at the fair for the week was 172,500, indicating that approximately one-half of the total number of visitors to the fair paid to see the show, and more than two-thirds of the persons who entered the big fair park actually saw it.

A total of 202 passenger cars; two electric cars; fourteen motor trucks, and thirty-one accessory exhibits were crowded into Automobile Hall this year.

Dealers of note from many parts of the country came to Milwaukee this week to inspect the exposition and get a line on the reasons for the great success achieved by the Milwaukee dealers' association in conducting a show at a State fair. Since the motor car became a factor, it has been exhibited at State and county fairs, generally under canvas, or in an open shed, not far from cattle and sheep, or in some corner of the fair grounds not needed for something else. It was the same at the Wisconsin State fair until 1915, when the M. A. D. leased a great concrete, shed-like "Machinery Hall," spent several thousand dollars in walling in the four sides with steel and glass, and leased out space to its members and other tradesmen on the same basis as it did for the annual show held in the Auditorium.

When the fair was over and the show closed its doors, there was enough left from the small admission charge so that every member of the association could receive a percentage return on his expense. Not only that, but every exhibitor was more than satisfied that his expenditure was well worth while on the basis of sales actually made and agencies actually placed.

Although not scheduled to open until Monday, Sept. 11, at 10:30 a. m., the show was ready for inspection at 2 o'clock Sunday afternoon. This year's fair was a 7-day event, instead of running only 5 days, as in former years.

$3,200 for Roads

On Wednesday, which was State and Good Roads day, the M. A. D., as previously pledged, turned over the entire receipts of the show to the Good Roads Association of Wisconsin, to further highway improvement propaganda. It is said that more than $3,200 was realized in this manner.

The booster tour took care of practically all the advance work of the association. It called the attention of from 750,000 to 1,000,000 people to the State fair automobile show.

30,000 Automobiles at Iowa Fair

DES MOINES, IOWA, Sept. 16—Over 30,000 automobiles, valued at about $200,000,000, passed through the gates of the Iowa State Fair during the 10 days of that recent event. Over 5000 cars entered the grounds daily on several of the big days of the fair, and ten men were working at top speed to take care of the car entrances during the rush hours. The fair this year, with a total attendance of over 300,000, was the greatest in the history of the State.

Car Show Building at Brockton

BROCKTON, MASS., Sept. 18—A $25,000 automobile exhibition hall is to be erected on the Brockton Fair Grounds. It will have display space for 108 cars, and will be completed the latter part of September. It will be 200 by 125 ft., with only two rows of posts, and will be electrically lighted.

Automobile Hall, in which the Milwaukee dealers held their exhibit at the State Fair

Giant's Despair Climb Oct. 7

A. A. A. Sanctions Revival of Classic—Eleven Events Based on Car Prices

WILKES-BARRE, PA., Sept. 18—The Giant's Despair Hill Climb will be held Oct. 7, according to the A. A. A. sanction.

The events are based upon the selling price of the cars entered, and are: 1, under $800; 2, under $1,200; 3, under $1,600; 4, under $2,000; 5, under $3,000; and 6, under $6,000; 7, Class E, non-stock, open to Class C cars with less than 230 in. displacement; 8, Class C, non-stock, division 6C, 231 to 300 in.; 9, Class C, free-for-all; 10, members of the Wilkes-Barre Auto Club, cars costing under $1,600; and 11, cars owned by members of the Wilkes-Barre Club, costing more than $1,600.

Omaha to Have Closed Car Salon in October

OMAHA, NEB., Sept. 20—A distinctly new departure is the closed automobile salon, first to be held in the country at Omaha during the latter part of October, and intended to become an annual event, the same as the regular automobile show, usually held in February, with which it will not conflict. It will be held in the main aisle of the main Brandeis Stores building, and will include the display of some forty closed cars.

If possible the salon will be kept open during the evening. It is planned to continue it for 3 days. Arrangements are in charge of a committee of three, headed by Clarke G. Powell.

N. Y. C. Sets Aside Parking Space, Due to Strike

NEW YORK CITY, Sept. 16 — Special parking space has been provided in downtown New York for the large numbers of automobiles now being used by business men in reaching their offices, owing to the lack of transportation facilities caused by the traction strike. The following spaces have been set aside to meet these temporary conditions:

State Street, around park curb.

Battery Place, up to park curb.

Wall Street, Pearl to South Street, one line in center of street.

Burling Slip, Water to South Street, one line in center of street.

West Street, Rector to Cortlandt Street, two lines along outer edge of marginal way.

West Street, Christopher to Gansevoort, two lines along outer edge of marginal way.

Twelfth Avenue, Twenty-fourth to Thirtieth Street, two lines along outer edge of marginal way.

Fifty-seventh Street, Eighth to Eleventh Avenue, two lines in center of street.

Fourteenth Street, Fourth Avenue to Broadway, inside police stanchions on south side of street.

Fourth Avenue, Sixteenth to Seventeenth Street, vehicles to be backed up to west side of park curb.

Fourth Avenue, north of Fourteenth Street, vehicles to be backed up on west side to railing around monument.

Blevins and Davis in Merger

$500,000 Deal Combines Studebaker Dealers—New Co. Has Six States

CLEVELAND, OHIO, Sept. 16—The Blevins Auto Sales Co., Toledo and Cincinnati, and the A. R. Davis Motor Co., Cleveland, both Studebaker dealers, have been merged into a new $500,000 company headed by Harry W. Blevins. The company has contracted for $12,000,000 of Studebaker cars and will have the distribution of Studebakers in Ohio and portions of five adjoining States. The company starts with three buildings, in Cleveland, Cincinnati and Toledo. Associated with Blevins, who is president of the new company, are Vice-President A. R. Davis, Cleveland; Treasurer J. O. Hahn and Secretary H. G. Rossiter, Toledo. Davis was at one time branch manager for the Studebaker corporation and up to this time Hahn has been Cleveland branch manager.

Harry Newman Resigns

CHICAGO, ILL., Sept. 19—Harry Newman, president of Harry Newman, Inc., Chalmers dealers in Chicago, Milwaukee and Springfield has resigned to take a factory position. S. E. Comstock has been made general manager of the Chicago branch. Joseph B. Diebler will control the Milwaukee branch and J. D. Sullivan, Springfield.

Theft Insurance Rates Raised

BLOOMINGTON, ILL., Sept. 16—Increased rates for insurance against automobile theft have been decided upon by the Western Automobile Underwriters. The lower-priced cars, which are in greater danger of theft, due to difficulty in identification, have been raised from $2.75 to $5. On cars valued at $700 to $1,200 the rate has been increased from $2.25 to $3.50. The rate on cars valued at $1,200 to $2,100, has been raised from $2 to $3, while on the higher-priced cars, the advance has been from $1.75 to $2.

Capital-to-Capital Car in Detroit

DETROIT, MICH., Sept. 16—The capital-to-capital touring Hupmobile reached this city to-day to pay its respects to the originator of the tour, President J. Walter Drake of the Hupp concern. The party left Lansing, the capital of Michigan, and the sixteenth visited so far by the car, early in the day, and was met just outside of Detroit by a large party of good-roads enthusiasts, who formed a guard of honor, and, escorted by a band, brought the touring car through the downtown streets of the automobile metropolis and out to the Hupp factory.

Detroit marks the end of the first division of the long hike. It means that the car has now traveled 3050 miles of the 20,000-mile trip it has undertaken with the intention of visiting every State capital in the interest of good roads. The car left Washington, D. C., the starting point, on Aug. 28.

Locomobile Holds Fourth Sale

NEW YORK CITY, Sept. 18—The Locomobile Company of America is holding its fourth semi-annual exchange car show and sale this week at its New York branch. The branch salesroom on West Sixty-first Street is devoted entirely to exchanged and rebuilt Locomobiles.

Ohio to Drive Out Motor Leagues

COLUMBUS, OHIO, Sept. 16—State Insurance Superintendent Frank Taggart declared he would start at once the task of driving out of Ohio all of the motorists' leagues and organizations which sell with their membership psuedo insurance policies which provide, besides membership in the organization, monetary compensation in case of accidents, free legal advice, free legal defense and many other attractive features.

Judge Taggart ruled these organizations are doing an insurance business without complying with the insurance laws of the State, and as such are illegal and their agents are subject to prosecution.

Arrested as Tire Swindlers

AKRON, OHIO, Sept. 16—Carl F. Geyer, manager of the Double Service Tire & Rubber Co., here, and manager of two other tire concerns, and Ralph C. Harper, assistant manager, were placed under arrest here by Federal authorities on a charge of using the mails to defraud.

Geyer and Harper are charged with doing a fraudulent mail order business, and Federal authorities said they had sold hundreds of defective tires, representing them as standard quality.

The arrests are the result of a year or more of investigation here by Federal officers and automobile clubs of Northern Ohio.

Geyer and Harper also are alleged to have been receiving tires for repair without returning them. They sold stock in the company for 25 cents and guaranteed buyers 80 per cent dividends, according to Federal officers.

Velie Represented in Australia

MOLINE, ILL., Sept. 16—The Velie Motor Vehicle Co., this city, has closed with Andrew Robertson, representing Clutterbuck Bros., Sydney, Australia, for representation of the Velie line in that country.

J. W. Packard a Packard Dealer

Buys Buffalo Branch of New York Co.—Will Also Handle Liberty

BUFFALO, N. Y., Sept. 18—J. W. Packard, who founded the Packard Motor Car Co., Detroit, Mich., and who gave his name to the car, has re-entered the automobile industry. He has purchased the Buffalo interests of the Packard Motor Car Co. of New York, and will conduct the Buffalo branch as an agency, handling the Packard and the Liberty. Mr. Packard is president of the new business, which is called the Packard Buffalo Motor Co., Inc. B. C. Day, former manager of the branch, is vice-president, and the other directors are: W. D. Packard, capitalist, a brother of the president; E. C. Sutton, president of the Wheat's Ice Cream Co., and L. R. Davidson of the Davidson Ore Mining Co.

The first Packard car was built in Warren, Ohio, by J. W. Packard, in 1899. While the business was still in its infancy Mr. Packard sold his interest to the group which now controls it, and has not been actively connected with the industry since.

The Packard Motor Car Co. of New York has opened a branch in White Plains.

Iowa Denby Dealers Meet

DES MOINES, IOWA, Sept. 16—Iowa dealers for the Denby Motor Truck were assembled here during State fair week, and at their convention listened to talks by Garvin Denby, president of the company, and W. J. Aitken, sales manager, who came from Chicago for the event. President Denby predicted a big business ahead in Iowa for the motor truck men, both among farmers and merchants.

Abler Opens Office in N. Y.

NEW YORK CITY, Sept. 18—M. M. Abler, manufacturers' representative, with branches in Amsterdam, Holland, Birmingham, England, and Soerabaya, Java, has opened a New York office at 32 Union Square East. The concern is now representing Studebaker cars, Goodyear tires, the Automobile Supply Mfg. Co., Brooklyn, N. Y., and intends other connections.

Bearings of Pa. Branch in Chicago

PHILADELPHIA, PA., Sept. 16—The Bearings Co. of Pennsylvania, this city, will open a branch in Chicago. Louis C. Smith, formerly associated with the Class Journal Co. in Chicago, will be manager.

Factory Miscellany

Standard Tire Plant Progresses—The new unit of the plant of the Standard Tire & Rubber Co., Willoughby, Ohio, is almost completed. It contains a power plant sufficient to turn out 1500 to 1800 tires per day. Equipment has been ordered. The company is now bringing out a black tread tire guaranteed to run 3500 miles.

Atterbury Rebuilds—Atterbury Motor Car Co., Hertel Avenue, Buffalo, N. Y., is rebuilding its factory recently destroyed by fire. The estimated cost of the new factory is $50,000.

Tire Plant for Belleville—Maple Leaf Tires, Ltd., has secured a factory site of 22 acres in Belleville, Ont., and has commenced building operations. The company will employ 100 hands at the start. The main building will be nearly 300 ft. long and of concrete and steel construction. It is intended to rush it toward completion before cold weather sets in. Fifty men are now at work preparing for the foundation.

Overland Service Plant in Brooklyn—The Willys-Overland Co. has leased a site 150 by 130 at St. Marks and Underhill Avenues, Brooklyn, N. Y., on which it will erect a service plant. The rental for a period of years is $100,000.

Hudson Service Plant in N. Y.—The Hudson Motor Car Co. of New York, Inc., has let the contract for a service station, 203 by 239, four stories, between West Sixty-eighth and West Sixty-ninth Streets and the North River.

Tom Thumb Tractor Grows—The Tom Thumb Tractor Co., University and Thirtieth Avenues, S. E., Minneapolis, Minn., plans increasing its facilities to twenty-five tractors per day by April 1, 1917. The plant now makes ten tractors per week and employs about thirty men. This number may be increased to 200.

Harrow Spring Adds—The Harrow Spring Co., Kalamazoo, Mich., is to build a large addition to its plant.

Christensen to Expand—The Christensen Engineering Co., Milwaukee, Wis., which has increased its capital stock from $300,000 to $1,000,000, will immediately increase its output of the Christensen air-starting mechanism. The starter is generally used on fire department cars, aeroplanes and motor trucks, many having been shipped to Europe in the last 18 months for war purposes. The factory at 841 Thirtieth Street will be enlarged and from 75 to 100 men added to the payroll.

Boone County Tire Buys Site—The Boone County Tire and Rubber Co. has been organized and will shortly commence the manufacture of tires at Belvidere, Ill. Ten lots have been purchased in a suburb of that city and plans have been prepared for the necessary buildings. When in operation, the plant will turn out 200 tires per day and will employ from 150 to 200 persons. It is hoped to have the buildings erected and machinery installed by Jan. 1.

Parker Rust Proof to Build—The Parker Rust Proof Co., Detroit, Mich., which will manufacture a rust-proof liquid used on motor cars, has purchased a site on Conant Road, in Hamtramck, for a factory, work on which has already been started. It is stated that 700 men will be employed in the plant.

Big Four Tire Plant—The Big Four Tire and Rubber Co., Cleveland, Ohio, has purchased as temporary quarters the plant of the Ohio Rubber Co. on the Lake Shore and Big Four tracks at Berea for about $12,000. There are 18,000 sq. ft. of floor space in the plant, which occupies a tract of 5½ acres. The company is moving its machinery into the building and expects to begin manufacturing in about 60 days. The company is to manufacture a patented combination rubber, fabric and steel tire.

United Smelting's New Mills—The United Smelting & Aluminum Co., Inc., New Haven, Conn., has opened its new rolling mills in that city. Work is furnished in aluminum sheets, coils, circles, etc., to any specifications.

Miller Has Factory Paper—The Miller Rubber Co., Akron, Ohio, is issuing a factory paper entitled "Miller Talk," every one of the 3000 employees being asked to contribute.

Firestone Opens in Kansas City—The new branch building of the Firestone Tire and Rubber Company in Kansas City, Mo., was opened Sept. 14, and a dealers' convention was held during the day, which was attended by 500 dealers from various points in the branch territory.

The new building is eight stories high, and contains shop, storage and shopping facilities.

The dealers spent part of the morning inspecting the new quarters and meeting the various Firestone executives from the home office in Akron. The day's events included a group photograph, luncheon, motor parade, business session, in which sales and distribution problems were discussed, and ended with a banquet in the evening.

The Automobile Calendar

ASSOCIATIONS

Sept. 25—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.

Oct. 2-7—Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.

Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.

Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30—Astor Cup Race, 250 miles, Sheepshead Bay Speedway, Sheepshead Bay, N. Y.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14—Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Oct. 21—Kalamazoo, Mich., Track Races, Kalamazoo Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

April, 1917—Los Angeles to Salt Lake City Road Race.

SHOWS

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.

Oct. 6-11—St. Louis, Mo., Open Week, Dealers' Assn.

Oct. 9—Kansas City, Mo., Fourth Annual Trade and Booster Tours, Kansas City Motor Car Dealers' Assn.

Oct. 14-31—Dallas, Texas, Show, State Fair.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 13-20—Montreal, Que., Show, Montreal Automobile Trade Assn.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Jan. 27-Feb. 3, 1917—Chicago, Ill. Show, Coliseum, National Automobile Chamber of Commerce.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers, and Dealers' Assn.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 3-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

TRACTOR

Oct. 14-29—Dallas, Tex., Demonstration, Texas State Fair.

The Week in the Industry

Picard & Stern Ford Dealers—A. J. Picard and E. Joseph Stern have opened a Ford agency at 1659 Broadway, New York City. Picard is the principal in A. J. Picard & Co., an accessory jobber and dealer and distributer of the Genemotor electric system for Fords. Stern is associated with Picard in the Picard company.

To Handle Scripps-Booth—Michigan distribution of the Scripps-Booth four and eight-cylinder cars has been secured by the newly-formed Oldsmobile Distributing Company, Detroit. Recently W. H. Collins and F. J. Muellerschoen bought out the Oldsmobile branch here, and the taking on of the Scripps-Booth adds another car to the line.

Howard Denneen's N. E. Sales Mgr.—S. B. Howard, formerly eastern and foreign representative of the General Motors Company, has been appointed New England sales manager of the Denneen Motor Company, Cleveland, Ohio.

E. P. Strang, formerly with the Kirk-Latty Mfg. Co., Cleveland, has been appointed middle western sales manager of the Denneen company.

Fisk Rubber Builds Service Station—The Fisk Rubber Company opened a new branch office and service station in Galesburg, Ill., leasing a new building, corner of Simmons and South Kellogg Streets. The Galesburg branch is one of a series being established throughout Illinois. The building has a frontage of 60 ft. and a depth of 80 ft. A vulcanizing department and repair shop will be inaugurated.

Earle and Boggs Open N. Y. Office—L. H. Earle and G. A. Boggs, who resigned from the Continental Motors Company last July, have incorporated as Earle & Boggs, to act as manufacturers' representatives for materials. Offices have been taken at 1790 Broadway, New York City, and accounts opened with the Pierce Governor Company and the Blood Brothers Machine Company.

King from Branch to Factory—Changes have been made at the New England branch of the B. F. Goodrich Co. at Boston by the promotion of officials to the factory. Edward King, for several years office manager, has been brought to Akron to join the administration forces. O. E. Hoeger, for some years office manager at St. Louis, has been moved to the Boston branch. C. E. Littlefield, who had charge of advertising and publicity at Boston, has been promoted to a position at Akron under E. C. Tibbetts. Mr. King was presented with a gold watch by his associates before leaving for Akron.

Storey Takes Maxwell in Canada—F. H. Storey, formerly an official of the Maxwell factory, at Detroit, Mich., has arrived in Winnipeg, Man., to take over the interests of the Maxwell Company of Canada, from Fort William to the Pacific Coast.

One of the first steps Mr. Storey will take will be the complete reorganization of the Maxwell service department in Winnipeg. Also there will be new showrooms of the type used by the Maxwell American firm during the New York-Chicago and Boston automobile shows last year, opened at 700 to 708 Portage Avenue.

Cleveland Retail News—The Jordon Motor Car Agency has been formed to handle the Jordon in Cleveland, Ohio, and space has been taken temporarily at 2052 Euclid Avenue. C. C. Neighbors, formerly of the Neighbors Motor Car Company, will be the manager, while V. E. Watkins will be sales manager. Their territory will consist of Cleveland and northeastern Ohio.

The Carris-Franklin Company, 1829 East Thirteenth Street, will handle the Franklin in Cleveland and adjacent territory. C. S. Carris has been associated with the Franklin organization for thirteen years. The employees of the service department of the agency all came from the Franklin factory.

The local sales office of the Standard Tire & Rubber Co., at Cleveland, has been moved from 5017 to 6521 Euclid Avenue. The executive offices remain in the Hippodrome Building.

J. Preston Penfield has been chosen president of the Luxurious Light Car Co., 1849 Euclid Avenue, Cleveland, to succeed J. M. Smith, who has gone to the Cole Sales Co. of Indiana.

E. D. Endsley has been appointed sales manager of the Alter Motor Car Company, distributer of Scripps-Booth and Liberty in Cleveland.

Gets H. A. L. in Ohio—A. W. Woodruff has organized the Woodruff Motors Co. and has opened offices and salesrooms at 2019 Euclid Avenue, having been appointed distributer of the H. A. L. for northern Ohio.

Edison Opens in Los Angeles—The Edison Storage Battery Supply Co. has opened its Los Angeles office on the fourth floor of the San Fernando Building, Fourth and Main Streets.

James F. Rogan, who has been acting as local distributer, will become resident manager.

H. A. L. California Distributers—The Eugene Schuler Co., San Francisco, Cal., has been appointed distributer for H. A. L. cars for the State.

Pearl Motor Car Co., Los Angeles, will have charge of the territory of southern California.

Mountain Trade News—The Colorado Motor Co., Denver, is the name of a new Reo distributing agency for Colorado, with headquarters at 1535 Cheyenne Place. The manager is George J. Hawley, formerly manager of the Reo-Saxon Auto Sales Co., Colorado Springs.

The William Thorney Auto Co., Denver, Apperson distributer for Colorado and Wyoming, has secured the Regal distributing agency for the same territory.

The Carter Motor Car Co., Denver, formerly the Overland Auto Co., which was Overland distributer for Colorado and Wyoming several years up to the recent opening of the Willys-Overland branch here, now has the King and Saxon distributing agency.

The Motor Bank, Denver, is the name of a bank just opened at 1245 Broadway, chiefly for the purpose of helping dealers finance their business when stocking up with cars.

The Roberts Auto Co., Denver, Marmon distributer for Colorado and Wyoming, is having a $20,000 building erected at 1231-1239 Broadway, on a $30,000 site. The building will be two stories high and 50 by 150 ft.

Heiser Brothers Co., Denver, Velie distributer for Colorado and Wyoming, has moved from 1236 Broadway into a new $38,000 building of its own at 700 Broadway. The new structure is 50 by 125 ft., one story and basement.

The Premier Motor Car Co. of Denver, is the name of a new $25,000 incorporation to distribute the Premier in Colorado, Wyoming and New Mexico. O. H. Woods is president and treasurer, and Charles H. Davis, formerly salesman for the Norton-Buick Co., is manager. The salesroom will be located in the Fisk Building.

The Cadillac Motor Co., Denver, Cadillac distributer for Colorado and Wyoming, is erecting a $40,000 fireproof building of steel, concrete and brick, on the corner of Broadway and East Fourteenth Avenue. It will be 50 by 133 ft., three stories and basement.

Full Complement of Balls with Uninterrupted Raceways of Full Depth.

Here we find the initial reason for the greater general efficiency of Gurney Ball Bearings—and for their special ability to carry exceedingly large thrust loads as well.

This feature is largely due to the unique design of Gurney Ball Bearings. First, in permitting a raceway literally full of balls—and secondly, in permitting the use of a full depth raceway with unbroken sides.

Some other bearings use as many balls as we do—but their raceways either are shallow or weakened by the use of a filling slot. Some other bearings have a full depth uninterrupted raceway—but they do not use as many balls.

In Gurney Ball Bearings only do you find full complement of balls with uninterrupted raceways of full depth.

Gurney Ball Bearing Company
Conrad Patent Licensee
Jamestown, N. Y
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PEERLESS MOHAIR TOP DRESSING

MAKES OLD TOPS LOOK NEW

Dries over night ready for use. Anyone can apply it. Over 8,000 auto painters use and endorse it

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Peerless Lining Dye
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Peerless Cylinder Enamel-Gray
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Peerless Ford Top Dressing
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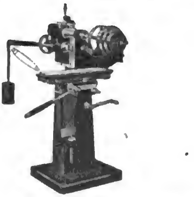

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Chains—Keys—Hand Milling Machines

Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

Ahlberg Bearing Co. 55
American Ball Bearing Co. 78
American Sheet & Tin Plate Co. 55
Atwater Kent Manufacturing Works 60

B

Bearing Co. of America 57
Beaver Mfg. Co. 57
Bosch Magneto Co. 81
Bossert Co. 61
Bound-Brook Oil-Less Bearing Co. 75
Boyle Co., A. S. 79
Braender Rubber & Tire Co. 64
Brown-Lipe-Chapin Co. 61

C

Celfor Tool Company 60
Central Steel Company 86
Champion Ignition Co. 66
Columbus Varnish Co., The 48
Combination Rubber Mfg. Co. 57
Connecticut Telephone & Electric Co. 57
Continental Motor Co. Front Cover
Corcoran-Victor Co. 56
Cullman Wheel Co. 55

D

Detroit & Cleveland Nav. Co 62
Dover Stamping Mfg. Co. 49
Dyneto Electric Co. 58

E

Eclipse Machine Co. 61
Edmunds & Jones Corp. 58
Eisemann Magneto Company 67
Electric Auto-Lite Co. 60
Electro Metal Products Co. 59
Engineering & Tube Bending Works 55

F

Fahrig Metal Co. 60
Firestone Tire & Rubber Co. 68
Foster Accessories Co., C. H. 67
Fracto Specialty Co. 55

G

Gibson-Hollister Mfg. Co. 61
G-O Manufacturing Co. 66
Golden-Belknap-Swartz Co. 74
Grossman Co., Emil 59
Gulf Refining Company 60
Gurney Ball Bearing Co. 47

H

Hartford, E. V., Inc. 56
Hess-Bright Mfg. Co. 72
Hotel Lenox 66
Houk Mfg. Co. 58
Hoyt Metal Company 49
Hyatt Roller Bearing Co. 56

I

Indiana Rubber & Insulated Wire Co. 56

J

Johns-Manville Co., H. W. 59
Johnson Company 76
Johnson & Sons, S. C. 71

Index to Advertisers

K

K-W Ignition Co. 63
Keystone Vehicle Co. 62
Kissel Motor Car Co. 82 & 83

L

Liberty Motor Car Co. 57
Lozier Co., H. A. 64

M

Mercer Automobile Co. 58
Merrill Spring Co., E. R. 55
Milwaukee Machine Tool Co. 56
Moltrup Steel Products Co. 59
Motor World 60
Mutty Co., L. J. 63

N

National Rubber Co. 60
Newark Stamping & Foundry Co. 55
New Departure Mfg. Co. 59
New Process Gear Corporation 56
Nordyke & Marmon Co. 69 & 70
Norma Co. of America 3
N. J. Car Spring & Rubber Co. 55
N. Y. & N. J. Lubricant Co. 65

P

Pantasote Company 65
Park Drop Forge Co. 65
Perlman Rim Corp. 55
Pfau Mfg. Co. 62
Pittsfield Spark Coil Co. 73
Porcelain Products Company 61
Prest-O-Lite Co. 58

R

Rajah Auto Supply Co. 58
Rayfield Carburetor Co. 84
Regal Motor Car Co. 85
R. & H. Platinum Works 59
Russel Motor Axle Co. 56

S

Salisbury Wheel & Manufacturing Co. 57
Seiss Mfg. Co. 59
Sheldon Axle & Spring Co. 58
Simms Magneto Co. 64
Splitdorf Electrical Co. 62
Spring Lock Nut Company 1
Sterling Motor Co. 63
Stewart-Warner Corp. 2nd Cover
Stromberg Motor Devices Co. 58
Studebaker Corp. 4

T

Tuthill Spring Company 77

U

U. S. Ball Bearing Co. 80

W

Ward Leonard Electric Co. 57
Warner Gear Company 3rd Cover
Waukesha Motor Co. 59
Weston Electrical Instrument Co. 57
White & Bagley Co. 2
Whitney Mfg. Co. 48
Willys-Overland Co. Back Cover
Winkley Co. 60

Z

Zenith Carburetor Co. 56

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SOLVES THE PROBLEM

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It is a round metal container with removable covers at each end—each cover is provided with a spring socket which holds the bulb more securely than in the lamps.

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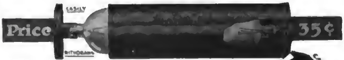
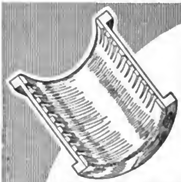


CARRY IT IN YOUR TOOL KIT



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Axle with Transmission—$35

Regal engine, magneto, clutch everything	$85
MAGNETOS high tension, K W 4 cyl.	15
Bosch 4 cyl. $20; Bosch 6 cyl. $35 Remy	7
Splitdorf dual or Michigan magnetos	8
Carburetors, all makes, $3 to $8, Front axles I beam	8

We *Wreck* cars of all makes, let us know in first letter what you need—above is only some of our bargains. No catalog of parts issued.

Progress Auto Parts Co.
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Imported make
All sizes in stock
Immediate delivery

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The reason we urge our customers to buy early is because this sale includes only a limited quantity of Special Bargains, which won't last long at such record-breaking prices.

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Studebaker "6" 1912 radiators, each	25.00
V-shaped brass honeycomb radiators for Fords	26.36
V-shaped German silver honeycomb radiators for Fords	27.65

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Holley carburetors for Fords, each	5.40
Kingston carburetors for Fords, each	5.40
Double bulb head lamps with wiring and switch for Fords, per pair	6.50

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Left hand drive Gemmer steering gear, each	15.00
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Many makes of wheels (all sizes), each	3.00

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36 x 4 1912 Detroit straight side rims, each.	2.30
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We have many sizes and types of brake drums ranging from $1.25 each and up.

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Many sizes and types, $50.00 up.

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We have bodies for most makes of cars at reduced prices and can also furnish them with tops, windshields, fenders, running boards and dust-shields, complete.

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If your car is not listed write us the name and model and we will quote you prices on repair and service parts.

Hundreds of other bargains not listed. Write for our large illustrated Bargain Bulletin. It is free upon request and will absolutely save money.

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All Parts For All Cars
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Be Wise!
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Why Overpay?

We can furnish you almost anything and everything in used parts and accessories, if it's only from an automobile. We have it on hand for prompt delivery.

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We Can Save You Money!

We have Motors, Transmissions, Axles, Magnetos, everything at lowest prices.
Send us your old part and we will ship exact duplicate.

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FIVE DOLLARS

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Ohio's Largest Auto Supply House
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Immediate service on all repair parts for every model. Parts made from original patterns and records which are in our sole possession.

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Order only from the factory direct. We carry no stock of parts elsewhere.

Imperial Automobile Parts Co.
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We also carry a complete line of
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All work guaranteed.
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Repaired by patent electric process. Filled with a silver and nickel alloy. Eliminates grinding. No warping or enlarging of cylinder bore. Same piston and rings used. Reshipped 24 hours after received.
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Aluminite Pistons will put six-cylinder smoothness into a four-cylinder motor, give more power and quicker getaway. In asking prices, state make, model and year. EXPERT MOTOR BUILDING—Piston Rings, Cylinder Grinding, also Piston Pins, Aluminite Connecting Rods and Racing Motors.
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LARGEST BECAUSE BEST
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Pistons, Rings and Wristpins made to fit. All work guaranteed. Write for information and quotations.
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CYLINDERS REBORED AND GROUND
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We Rebore Cylinders and equip with our **Eclipse** rings and extra high quality pistons, insuring a correct fit and giving extra efficiency to your motor. Give us a trial. Prices interesting.
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By experts on Heald Grinder. All pistons, rings and wrist pins ground mechanically perfect. All patterns and sizes in stock. Write for quotations.
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Special Light Alloy Pistons
Our special facilities enable us to do highest grade work.
Over 225 Piston Patterns
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Will increase speed and power, reduce vibration and eliminate carbon trouble. We are the first in New York to offer these pistons to motorists. **Get our prices on regrinding cylinders and for ALUMINUM ALLOY PISTONS.**
Oversize Pistons, Pins, Rings and Bushings.
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Guaranteed work. Lowest prices and immediate service. Let us prove it on your next repair job.
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Your **auto cylinders** may need **reboring and new pistons and rings** made. Manufacturers acetylene welding and cutting and carbon consuming apparatus. We **weld and braze** any metal that melts.
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Soap, Water and Towel

Everything necessary to a thorough cleaning of the hands after a roadside repair.

An ingenious, compact cylinder containing a metal tube filled with antiseptic washing fluid and roll of sanitary, absorbent paper towels. Enough for 50 washes and easily refilled.

Everybody wants one—nearly every motorist buys one.

A big business for the supply dealer at a liberal profit.

Get a stock now. They sell on sight.

Send for details of our dealer proposition. List price $1.00—Refillers (fluid and towels) 50 cents.

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Handy Pocket Kitty-Kit Prevents Tire Troubles. Use the wonderful "Kitty-Kit" tire repair kit and your troubles will be solved. Repairs punctured tires in one minute. This is a kit of real merit and a help to all automobile owners. Price $3 by mail. Agents wanted. **Andrew B. Smith,** S. W. Cor. Park Ave. & Cambria St., Phila., Pa.

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Money cheerfully refunded on anything that is unsatisfactory.

Our PRICE WRECKER catalogue contains 3,000 big bargains—GET A COPY.

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New fresh stock, tires and tubes. Don't be skeptical of our low prices.

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	Tires	Tubes		Tires	Tubes
32x3	$9.50	$1.90	36x4	$15.40	$3.10
32x3½	8.85	1.95	34x4½	15.80	3.40
34x3½	9.95	2.10	35x4½	16.85	3.80
31x4	12.20	2.65	36x4½	17.10	3.95
32x4	12.30	2.90	37x4½	17.85	3.95
33x4	13.30	2.95	35x5	17.25	4.25
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35x4	14.15	3.20	37x5	18.90	4.65

10 per cent additional for non-skid.

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IDEAL DOUBLE TREAD TIRE.

Adjustable at our office on a 4000 MILEAGE BASIS.

NO STITCHES ON INSIDE TO INJURE YOUR INNER TUBES

28 x 3	4.75	1.25	35 x 4	9.85	3.45
30 x 3	5.25	2.00	36 x 4	10.50	3.50
30 x 3½	6.50	2.25	34 x 4½	10.95	4.00
31 x 3½	6.80	2.50	35 x 4½	11.20	4.15
32 x 3½	7.35	2.50	36 x 4½	11.75	4.25
34 x 3½	8.00	2.55	37 x 4½	12.20	4.35
31 x 4	8.25	2.90	35 x 5	12.65	4.90
32 x 4	8.75	3.20	36 x 5	13.00	5.00
33 x 4	9.20	3.25	37 x 5	13.45	5.20
34 x 4	9.50	3.35	38 x 4½	14.60	5.40

Add 10% for Non-Skid.

NO PUNCTURES. NO BLOW-OUTS. NO TIRE TROUBLE

The above is practically eliminated from these tires. THIS IS NO IDLE BOAST. BE CONVINCED BY SENDING US A TRIAL ORDER.

One dollar or deposit sufficient to defray express charges required with each order. Shipments sent promptly C.O.D. subject to your inspection.

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(Formerly Empire Double Tread Tire Co.)
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Before Buying Double Tread Tires

send us your old Tire and we will Double Tread it at the following prices:

Size	Price	Size	Price
30x3½	$4.50	34x4	$6.00
32x3½	5.00	36x4½	8.00
33x4	6.00	37x5	9.00

LEON JAFFESS, INC.
252 West 55th St., New York City

DOUBLE SERVICE TIRES
Guaranteed 3500 Miles

Size	Plain	Tubes	Size	Plain	Tubes
30x3	$5.00	$2.05	36x4	$9.00	$3.80
30x3½	6.00	2.40	36x4½	10.00	4.00
33x4	8.00	3.45	36x5	11.00	5.45
34x4	9.00	3.60	37.5	11.00	5.55

Non-skid Tires, all sizes, $1.00 Extra.
State if Q. D. straight bead or clincher type.
10% Deposit required on all C. O. D. orders.
Discount of 5% when cash accompanies order.
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Branch—282J Halsey St., Newark, N. J.

FORD SIZE TIRES

30x3½ Non Skid, First Grade
MILEAGE GUARANTEE REMOVED
$7.00 Each

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1761-3 Broadway, 303 W. 59th St., New York City

TIRES

Akron Standard

Buy your tires from us and save money.

Compare our prices with others.

Size	Plain	Non-Skid	Tubes
28 x 3	$5.25	....	$1.80
30 x 3	5.50	$6.75	1.90
30 x 3½	6.95	7.50	2.15
32 x 3½	7.95	8.75	2.25
34 x 3½	8.85	9.75	2.35
30 x 4	9.45	10.50	2.85
31 x 4	9.65	10.60	2.95
32 x 4	9.75	10.75	3.05
33 x 4	9.85	10.85	3.10
34 x 4	9.95	10.95	3.20
35 x 4½	10.45	11.45	3.30
36 x 4	10.95	11.95	3.35
34 x 4½	12.45	13.45	4.00
35 x 4½	12.95	13.95	4.10
36 x 4½	13.50	14.50	4.15
37 x 4½	14.45	15.45	4.25
35 x 5	15.00	16.00	4.90
36 x 5	15.45	16.45	4.95
37 x 5	15.95	16.95	5.05

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Authorized Capital, $300,000.00
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NEW BLEMISHED TIRE BARGAINS

(3,500-Mile Guarantee)

30x3 .... $6.00 34x4 .... $12.50
30x3½ .... 7.50 36x5 .... 17.00

We Double Tread your old tires and guarantee perfect satisfaction. Give us a trial.

For recovery, 30x3......$4.00 30x3½....$4.50
34x4......$6.00
Non-Skid 10% Extra.

UNEEDA TIRE CO.
262 Halsey St. Newark, N. J.

Reduce Your Tire Bills
by using our
DOUBLE TREAD TIRES

30 x 3½........$6.00 34 x 4..........$8.00
36 x 4½..........$10.00

Write for Illustrated Catalogue and Price List to **B. Liben & Co., 261 W. 54th St., New York.**

A Big Saving of Manufacturers' Surplus Stock of

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All Fresh Selected Stock—Standard Makes

GUARANTEED

Size	New Tires	New Tubes	Size	New Tires	New Tubes
28x3	$ 6.00	$1.25	34x4	$13.25	$3.35
30x3	6.50	2.00	35x4	13.50	3.45
30x3½	8.00	2.25	36x4	14.00	3.50
31x3½	8.50	2.50	34x4½	16.25	4.00
32x3½	9.00	2.50	35x4½	17.00	4.15
34x3½	9.50	2.55	36x4½	17.50	4.25
36x3½	10.75	2.75	37x4½	18.00	4.35
31x4	11.75	2.90	35x5	17.50	5.00
32x4	12.50	3.20	36x5	18.50	5.00
33x4	12.75	3.25	37x5	20.00	5.20

Add 10 per cent to the above prices for non-skid.

Special bargains in slightly used and demountable tires.

Size	Used Tires	Used Tubes	Size	Used Tires	Used Tubes
30x3	$3.50	$1.35	35x4	$7.50	$1.75
30x3½	4.25	1.43	36x4	7.50	1.75
31x3½	4.50	1.50	34x4½	8.00	1.75
32x3½	5.25	1.50	35x4½	8.00	1.80
34x3½	5.50	1.60	36x4½	8.25	1.85
31x4	6.25	1.65	37x4½	8.50	1.90
32x4	7.00	1.60	35x5	8.50	2.00
33x4	7.25	1.70	36x5	8.50	2.00
34x4	7.73	1.70	37x5	8.75	2.20

We guarantee all tires sold by us at the above prices to be free from imperfections in material and workmanship. Send one dollar deposit with each tire ordered. Tires will be sent promptly C. O. D. with privilege of examination. Specify style of rim to avoid delay.

Tire Repair & Supply Co.

1463 Michigan Ave. Chicago, Ill.

BIG BARGAINS IN REGULAR STANDARD GUARANTEED 3500 MILES TIRES and TUBES

SHARE OUR PROFITS

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28x3	$ 6.35	$ 7.00	$1.75
30x3	6.95	7.45	1.85
30x3½	8.95	9.50	2.05
32x3½	10.30	10.85	2.20
34x3½	11.50	12.15	2.25
32x4	14.10	14.85	2.75
33x4	14.65	15.45	2.85
34x4	14.95	15.75	2.90
35x4	15.55	16.50	3.00
36x4	15.80	16.60	3.10
35x4½	20.80	21.85	3.75
36x4½	21.10	22.15	3.85
37x4½	21.85	22.95	3.95
37x5	24.90	26.25	4.50

FULL LINE OF SLIGHTLY USED ALL STANDARD MAKES TIRES AND TUBES

Will run from 1500 to 3000 Miles

Size	Tires	Tubes	Size	Tires	Tubes
28x3	$3.25	$1.00	35x4	$7.25	$1.75
30x3	3.50	1.25	36x4	7.25	1.73
30x3½	4.25	1.35	34x4½	7.50	1.75
32x3½	5.00	1.40	35x4½	7.75	1.80
34x3½	5.75	1.45	36x4½	8.00	1.80
31x4	6.00	1.50	37x4½	8.50	1.85
32x4	6.50	1.45	35x5	9.00	1.90
33x4	6.75	1.65	36x5	9.50	1.95
34x4	7.00	1.60	37x5	9.50	2.00

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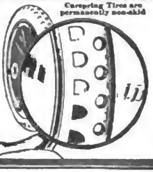

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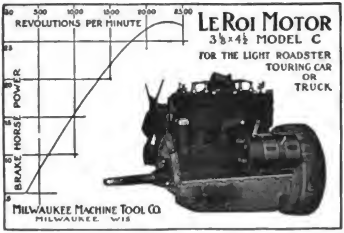

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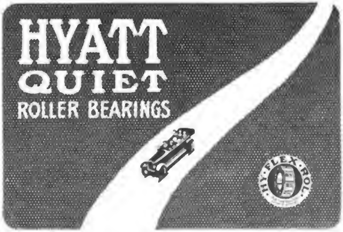

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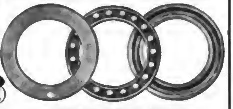

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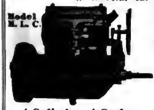

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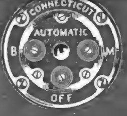

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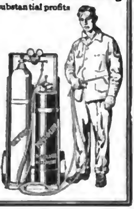

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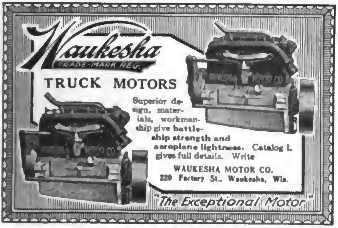

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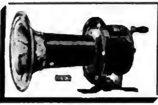

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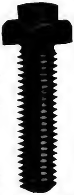

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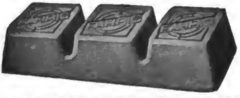

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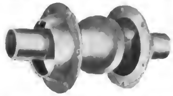

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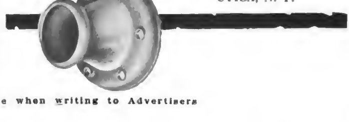

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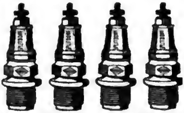

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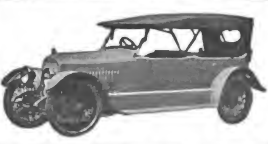
Keystone Vehicle Company
Reading Pa.



THE COAST LINE TO

MACKINAC

DETROIT

CLEVELAND, BUFFALO, NIAGARA FALLS

TOLEDO, PT. HURON, ALPENA, ST. IGNACE

A REAL VACATION

THE WATER WAY IS THE ONLY WAY

The Great Lakes is the mecca for particular and experienced travelers on business and pleasure trips. The D. & C. Line Steamers embody all the qualities of speed, safety and comfort. The freedom of the decks, the cool, refreshing lake breezes, the commodious state rooms and unexcelled cuisine make life aboard these floating palaces a source of enjoyment.

"D. & C. A SERVICE GUARANTEE"

During Summer Season the Two Giants of the Great Lakes, Strs. City of Detroit III and City of Cleveland III, operate daily service between Detroit and Buffalo; daily service between Detroit and Cleveland, also delightful day trips during July and August, as well as two boats out of Detroit and Cleveland every Saturday and Sunday nights during these two months. FOUR TRIPS WEEKLY FROM TOLEDO AND DETROIT TO MACKINAC ISLAND AND WAY PORTS—From June 25th to September 10th, SPECIAL STEAMER CLEVELAND TO MACKINAC ISLAND. TWO TRIPS WEEKLY. NO STOPS ENROUTE EXCEPT AT DETROIT EVERY TRIP. Daily service between Toledo and Put-in-Bay, June 10th to September 10th.

YOUR RAILROAD TICKETS ARE ACCEPTED

On D. & C. Line steamers for transportation between Detroit and Cleveland, Detroit and Buffalo, either direction. Send two cent stamp for illustrated pamphlet and Great Lakes Map. Address L. G. Lewis, G. P. A., Detroit, Mich.

DETROIT & CLEVELAND NAVIGATION COMPANY

PHILIP H. McMILLAN, Pres. A. A. SCHANTZ, Vice-Pres. & Genl. Mgr.

All D. & C. Steamers arrive and depart Third Avenue Wharf. Central Standard Time.

The Price of a Good Shirt Will Protect Your Car From Theft

For $3.50 you can provide your Ford with a

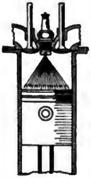
TRADE K-W MARK AUTOLOCK SWITCH

It takes the place of an ordinary switch. It can be attached to any make of coil in five minutes. Your key in your pocket is your assurance that you will find your car locked right where you left it. Without a key it is impossible to operate the switch. Removing the screws will not remove the lock unless your key is inserted. The K-W Autolock Switch is sold by reliable dealers for $3.50. If yours is out, sent prepaid on receipt of price. Illustrated literature on request.

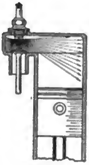
K-W Autolock Switch
$3.50 Complete

THE K-W IGNITION CO.
2833 CHESTER AVE. CLEVELAND OHIO U.S.A.
Makers of 150,000 K-W Master Vibrators

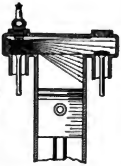
Sterling Valve in Head Motors



Valve in head



L Head



T Head

Take all the explosive force on the top of the piston and not in the valve pockets at the sides of cylinders.

That's one reason, along with superior design and workmanship, why they deliver more power at less cost than any others.

Power, economy and dependability are built into every "Sterling" valve in the head motor.

Ideal for light cars and trucks.

Write for particulars.

STERLING MOTOR COMPANY
DETROIT, MICH. - - - U. S. A.

AFTER ALL

It Is Quality That Counts

AND BULL DOG QUALITY IN RUBBERIZED FABRICS SEEMS TO COUNT WITH THE MOST PROMINENT AUTOMOBILE MANUFACTURERS IN THE UNITED STATES.

Its use means to you that the top and side curtains of your car will be waterproof, absolutely.

It means that the top and side curtains will stand up under hard usage; that when your car is 4, 5 or 6 years old, the top will look well and still be serviceable.

The prices on BULL DOG QUALITY are right; and the wearing quality will be a surprise and a delight to the owners of the cars you make.

Send for our samples and price list today. You need them.

L. J. MUTTY COMPANY
BOSTON, MASS.

H·A·L TWELVE

The "H.A.L. TWELVE" is today getting the interest of many of the largest and most experienced dealers in the country—for these reasons:

The amazing value of the car, the ease of operation without shifting gears, the ready market for a good, common-sense twelve-cylinder automobile. These, together with the strong syndicate of leading Cleveland manufacturers who are behind the "H.A.L. TWELVE" makes our dealers' proposition worthy of investigation.

BRIEF SPECIFICATIONS

Twelve-cylinder, valve-in-head motor, 2⅞" bore, 5" stroke.

Complete electric lighting and starting system, Westinghouse.

Three-speed selected transmission. Full floating rear axle.

40" semi-elliptical front springs, underslung 57" rear springs, left-hand drive, center control, 135" wheelbase.

7-passenger Touring Car	**$2100**
3-passenger Roadster	**2100**
4-passenger Shamrock	**2300**
7-passenger Limousine	**4250**
7-passenger Touring Brougham	**4250**

The H. A. Lozier Company
CLEVELAND OHIO

"The Tyre to Tie To"

A Real Non-Skid

BRAENDER TIRES

have attained an enviable reputation for Tire endurance, and can be depended upon to give a service eminently profitable and satisfactory to user and Dealer.

The Opportunity Is Yours

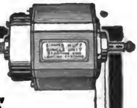
to build up a bigger and better business, *with more profit.*

Take advantage of the prestige of "Braender Quality," our Advertising and Dealer Co-operation, and write regarding territory unallotted — ***but do it NOW:***

Red, Gray and Pure Gum Tubes

Braender Rubber & Tire Co.
Factory: RUTHERFORD, N. J.
BRANCHES *250 West 54th Street, New York, N. Y.*
675 N. Broad St., Philadelphia, Pa.
1350-54 So. Michigan Ave., Chicago, Ill.
Agents in Principal Cities.

TRADE MARK



SIMMS MAGNETO
SIMMS-HUFF
ELECTRIC STARTING & LIGHTING

"We have had splendid success with the Simms high tension magneto on all of the cars we have sold. We think it one of the best and hottest magnetos we have ever come in contact with."
The Central City Garage, Central City, Iowa.

Quality Reliability
Efficiency

The SIMMS MAGNETO CO.
273 No. Arlington Ave.
East Orange, N. J.

One Can of Non-Fluid Oil Equals in Lubricating Value 3 Cans of Common Grease

Common grease *does not* lubricate until frictional heat melts it. Then it leaks away. Grease contains fillers which *do not lubricate*. You pay for them but *do not use them.*

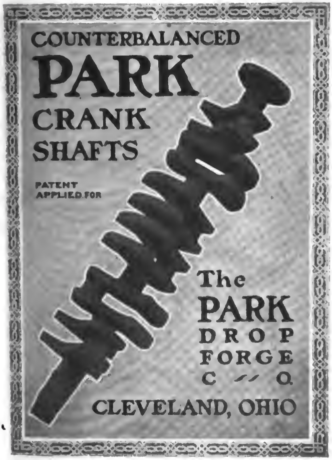
NON-FLUID OIL

Lubricates the instant the car starts and continues lubricating every second the car is in motion. Doesn't melt at bearing temperatures—*stays* where it is *needed*—and *all* of it is pure lubricant. It lasts three times as long as grease and gives your car *better* protection against friction, at *less* cost.

Get "K No. oo Special" grade for gears; "K No. ooo" for bearings. Sold only in orange-colored cans at your dealer's

Write for samples and a new book "Lubrication of the Motor Car."

New York & New Jersey Lubricant Co.
165 Broadway New York


COUNTERBALANCED
PARK
CRANK
SHAFTS

PATENT APPLIED FOR

The
PARK
DROP
FORGE
CO.
CLEVELAND, OHIO

In Selecting Automobile Top Material

bear in mind that value and durability are almost entirely dependent on the nature of the part exposed to the elements.

The remarkable durability of

Genuine
Pantasote
TOP MATERIAL

is due primarily to the composition used on the exposed side. This is a secret compound chemically different from the surface of all other top materials, whether they be a rubber mixture, or what is termed "artificial leather."

This substance (used exclusively in Pantasote) possesses unique properties which make it ideal for automobile tops.

It is impervious to grease, sunlight and extremes in temperature. It will stand lots of abuse and positively won't crack, leak or fade. It can be cleaned almost as readily as glass.

The ingredients used in Pantasote and the process of manufacture are such that it cannot be sold at the price of other top materials. The difference in cost, however, is more than offset by superior service rendered to the car owner.

The automobile maker who uses Pantasote pays more in order to give his customers the best top material money can buy, the top material used on the most expensive cars.

Pantasote is not and cannot be compounded or cheapened to meet price competition. It is made only in one quality—the best.

It is not safe to judge top material on its appearance. Inferior quality can be easily disguised with a deceptive surface finish. When new the good and the bad look very much alike.

TO USE THIS LABEL ON MATERIAL NOT
Pantasote
IS A PENAL OFFENSE

This label on a top shows the covering is genuine Pantasote and prevents substitution, which is not uncommon.

THE PANTASOTE COMPANY
1913 Bowling Green Building, New York City

This Is the Plug

These Are the Manufacturers Who Equip With

AC Spark Plugs

Packard
Pierce-Arrow
Cadillac
Marmon
Hudson
Chalmers
Hupmobile
Chandler
Haynes
Chevrolet
Dort
Cole
Dodge Brothers
Reo
Paige
Peerless
Buick
Oakland
Oldsmobile
Jeffery
Stearns-Knight
Saxon
Stutz
National
Velie
Jackson
Apperson
Davis
Detroiter
Paterson
McFarlan
Westcott
Enger
Lexington-Howard
Brockway Truck
Chase Truck
Daniels
Empire
Federal
G. M. C.
Gramm Trucks
Kissel Kar
Knox
McLaughlin (Canada)
Monroe
Pilot
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Crane-Simplex
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Stephens
United Truck
Wilcox Trux
Palmer-Moore
Roos-Davis
Murray
Jordan
Liberty
Netco Trucks
Moreland Trucks
Premier

No Greater Recommendation Can Be Given a Spark Plug

Have You This Plug On Your Car?

Sold Everywhere

Champion Ignition Co., Flint, Mich.

THE MARK OF A BETTER RADIATOR

QUALITY RADIATORS FOR PLEASURE CAR AND HEAVY DUTY SERVICE

G & O MFG. CO.

NEW HAVEN CONN.

The Ideal Hotel of Buffalo, N. Y.

HOTEL LENOX

Modern North Street at Delaware Avenue *Fireproof*

TRAVEL ALL AROUND THE WORLD AND YOU WILL FIND NOTHING SUPERIOR IN SURROUNDINGS OR SERVICE
BUFFALO'S IDEALLY LOCATED HOTEL

A unique Hotel of 250 rooms, with a most desirable location, insuring quiet and cleanliness.

Convenient to all points of interest—popular with motorists and visitors to Niagara Falls and Resorts in the vicinity — cuisine and service unexcelled by the leading hotels of the larger cities.

RATES—EUROPEAN PLAN

Room With Privilege of Bath

For one person, $1.50 per day

For two persons, $2.00 per day

Room With Private Bath

For one, $2.00, $2.50, $3.00 or $3.50 per day
For two, $3.00, $3.50, $4.00 or $5.00 per day

Two-Room Suite With Private Bath

For two, $4.00, $5.00, $6.00 or $7.00 per day
For additional persons, $1.00 per day extra, each

FIRST CLASS GARAGE

Motorists Should Follow Main St. or Delaware Ave. to North St.

May we send with our compliments a "Guide of Buffalo and Niagara Falls?"

On the EMPIRE TOURS. Booklet with maps and running directions will be mailed free on request.

C. A. MINER, Managing Director

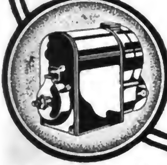
It's the Spark that Counts!

EISEMANN

MAGNETOS

furnish an intensely hot spark at all speeds, even the lowest. They are the most efficient, dependable and durable Magnetos made.

You will be quick to notice their superiority in the easy starting, the quick pick-up, the instant response of the motor.



THE EISEMANN MAGNETO CO.

Sales and General Offices:
32 33rd Street, Brooklyn, N. Y.

Indianapolis, Ind.
415-417 N. Capitol Ave.

Detroit, Mich.
802 Woodward Ave.

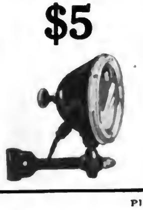
FOSTER OWL LIGHT

NOW ONLY $5

An avalanche of orders from all parts of the country followed the announcement that the famous FOSTER Owl Light had been reduced in price from $7.50 to $5.00. Constantly increasing demand, coupled with a resultant increase in production, made possible the reduced price. And the FOSTER Owl Light at the new price is in many respects superior to the higher-priced model.

In point of construction, finish, power and far-carrying ability the FOSTER Owl has never been equalled. That is one reason it is

Seen on America's Finest Cars



The searchlight has become a necessity to every motorist, more so since the dimming of headlights has become compulsory. The OWL LIGHT adds to the appearance of any make of car. Its patented FOSTER UNIVERSAL SWIVEL, which enables the user to place the light in any position desired, cannot be found on any other searchlight. This clean-cut, positive action swivel assures the searchlight staying in any position it is put.

FOSTER Owl Lights can be obtained from the highest-grade dealers everywhere. If your dealer cannot supply you, write us direct. In ordering, state make and model of car, also battery voltage.

GET THIS FREE BOOKLET!

Send for handsomely illustrated two-color booklet describing 50 different uses for the OWL Light. Dealers Wanted Everywhere.

C. H. Foster Accessories Co., 2303 Michigan Blvd., Chicago

Resiliency with Toughness

THE combination of extreme resiliency with long-wearing toughness in truck tire compounds is distinctively a Firestone success. It accounts for the most-miles-per-dollar service of Firestone tires and, what is equally important, the protection of motors, axles and frames by the elimination of shock and vibration. The fact that more Firestone truck tires are in use than any other make evidences the general knowledge and experience of truck owners as to Firestone quality. The Pressed-On tire here shown is one of the many Firestone types, which include a tire for every need.

It is the work of a few minutes at your local Firestone Service Station to press on to any S. A. E. standard wheel one of these strong, durable tires. They are applied direct to felloe band under heavy hydraulic pressure. "Creeping" is not possible. Call a Firestone traffic expert from your local station for details—and low prices.

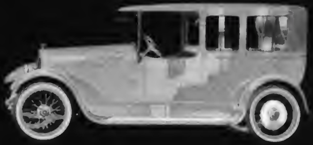
Firestone Tire and Rubber Co.
"America's Largest Exclusive Tire and Rim Makers"
Home Office and Factory: Akron, Ohio
Branches and Dealers Everywhere

MARMON
34

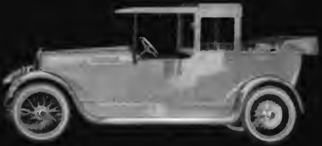
Light in weight, low, easy riding, luxuriously finished, there are many points of advantage that are found *only* in Marmon 34 closed cars. Scientific design and the extensive use of Lynite Aluminum make these cars lighter by 1100 pounds than other closed cars of equal size and power. The over-all height is several inches under the average, yet there is the usual head room inside. A low hung body, with low center of gravity and a new rear spring suspension, provides easy riding without side-sway.

NORDYKE & MARMON COMPANY
INDIANAPOLIS, IND.

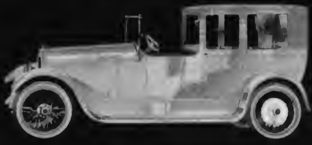
Marmon 34 Closed Bodies



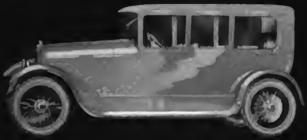
Unlike the usual car of this type, the Marmon 34 Limousine is not heavy nor is it high. It weighs only about 4000 pounds and the over-all height is only six feet nine inches, yet there is the usual head room and abundant passenger space.



With floor boards several inches lower than in the usual car, weight perfectly balanced, extra wide doors, abundant room inside, and deep upholstery, the Marmon 34 Landaulet is a car which gives "easy chair" comfort on the road.



Style and distinctiveness feature the Marmon 34 Town Car. Rapid acceleration, extraordinary power, quick acting brakes, and a short turning radius, make this Town Car ideal not only for crowded traffic but for the open boulevards as well.



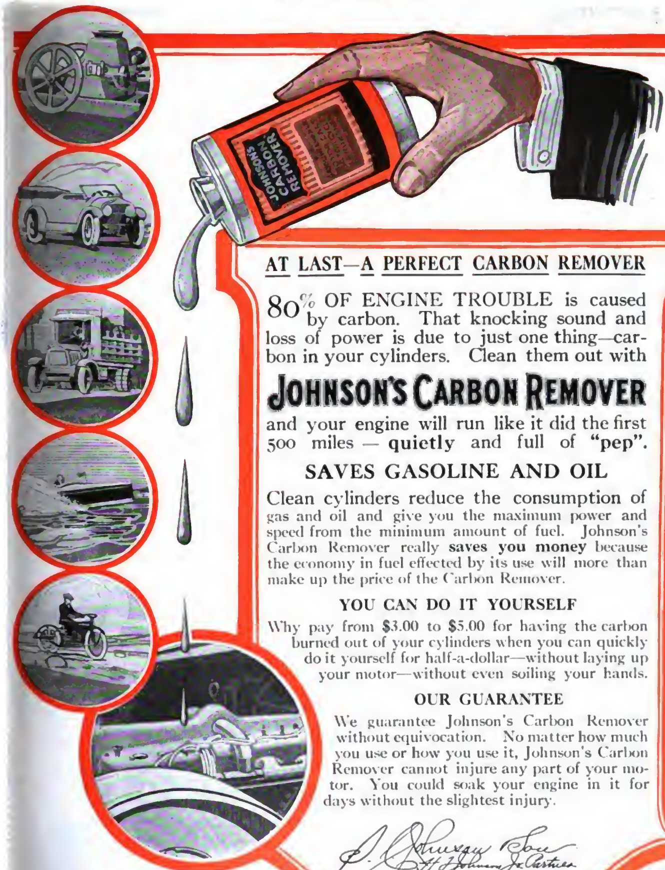
The Convertible Sedan is a fine family car. All the seats are enclosed, entrance is by a rear door on either side and front seats are separate. It can be used as a closed car or easily changed to an open car with only windshield, top, and rear portion in place.

"Holbrook," New York; "Kimball," Chicago; "Thompson," Pittsburgh; and "New Haven Carriage Co." are "Closed Body" names that need no emphasis. Experienced buyers of closed cars know them, and the class of work they represent. It is interesting and important to note, therefore, that each of these houses has produced exclusive designs for the Marmon 34 chassis, which will be furnished this season as regular Marmon closed car models.

The demand for the Marmon 34 chassis so equipped undoubtedly will equal that of the open car, for the closed models equal the now famous open Marmon in distinctive features and highly advanced design.

Nordyke & Marmon Co. *Indianapolis, Ind.*

ESTABLISHED 1851



AT LAST—A PERFECT CARBON REMOVER

80% OF ENGINE TROUBLE is caused by carbon. That knocking sound and loss of power is due to just one thing—carbon in your cylinders. Clean them out with

JOHNSON'S CARBON REMOVER

and your engine will run like it did the first 500 miles — **quietly** and full of **"pep".**

SAVES GASOLINE AND OIL

Clean cylinders reduce the consumption of gas and oil and give you the maximum power and speed from the minimum amount of fuel. Johnson's Carbon Remover really **saves you money** because the economy in fuel effected by its use will more than make up the price of the Carbon Remover.

YOU CAN DO IT YOURSELF

Why pay from $3.00 to $5.00 for having the carbon burned out of your cylinders when you can quickly do it yourself for half-a-dollar—without laying up your motor—without even soiling your hands.

OUR GUARANTEE

We guarantee Johnson's Carbon Remover without equivocation. No matter how much you use or how you use it, Johnson's Carbon Remover cannot injure any part of your motor. You could soak your engine in it for days without the slightest injury.

S. C. Johnson & Son
H. F. Johnson Jr. Partner

RACINE, WIS.

If your garage or accessory dealer cannot supply you with Johnson's Carbon Remover, order a can direct from us. We will prepay the express charges on your trial order.

Quarts, $1.50 - Pints, $.85 - Half-pints, $.50

HESS-BRIGHT'S CONRAD PATENTS ARE THOROUGHLY ADJUDICATED

HESS-BRIGHT BALL BEARINGS

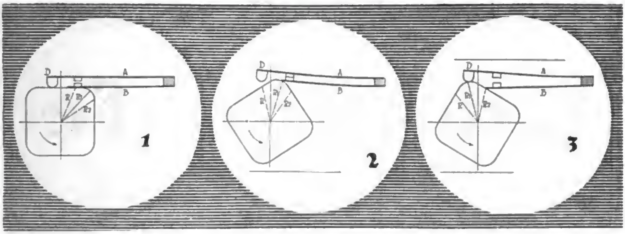
HAS IT EVER OCCURRED TO YOU that if the makers of a motor-truck choose HESS-BRIGHT BALL BEARINGS in preference to all other makes of bearings, it is done with the single purpose of giving the customer the best to be had, even though it increases the cost? The first cost of HESS-BRIGHTS is necessarily high.

The manufacturers of the SAURER TRUCK could easily substitute cheaper and inferior bearings, *but they won't if they can avoid it.* Their preference is HESS-BRIGHT BALL BEARINGS.

There have been instances since the beginning of the European conflict when we have not been able to supply our customers' requirements, but we are overcoming these difficulties by our rapidly increasing production.

The selection of HESS-BRIGHTS by the manufacturers of any motor vehicle is positive indication of earnest endeavor to build a purely quality product.

THE HESS-BRIGHT MANUFACTURING COMPANY
PHILADELPHIA, PA.



Three illustrations indicate roughly the make-and-break action. As the cam revolves it forces the two small contacts on A and B together at the corner of the cam, thus making the circuit. In the same cycle—that is, as the cam revolves in the direction of the arrow—the cam breaks the circuit by separating the contact points, as in Fig. 3. Note, however, that the making and breaking are not dependent upon the flat spring arms A and B, but rather on the positive mechanical cam action. This is true because even if the arm B at its contact point were to remain suspended in the air the continued rotation of the cam would still lift the arm A away from the arm B. First, the revolution of your cam positively and mechanically makes your circuit, and then, irrespective of any spring action, positively and mechanically breaks the circuit.

An Open Circuit with Positive, Mechanical Make and Break—without the Slightest Dependence upon Rapidity of Spring Action

PITTSFIELD DISTRIBUTOR

Trips, hammers, light springs—all done away with.

Current used only when needed to produce spark.

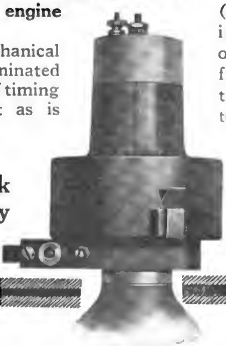
Current consumption exceedingly small, owing to short duration of contact.

Hot sparks assured at speeds **beyond the highest engine demand.**

Electrical and mechanical lags practically eliminated—synchronization of timing as nearly perfect as is humanly attainable.

All this is positively assured you by the new Pittsfield Distributor which, by its very nature, assures the most efficient sort of spark, positively and continuously, without the slightest danger of failure, either mechanically or electrically.

Compact, made into a single unit (including the coil), this ignition outfit has only one external wire, aside from spark plug leads, and that is the lead to the battery.

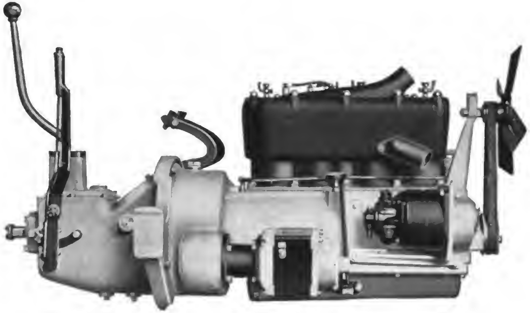


Pittsfield Spark Coil Company

**Pittsfield
Massachusetts**

9

Long Life



G·B&S motor

Four factors that assure long life are conspicuous features of the G. B. & S. motor.

These are, the substantial construction from highest quality material; the extra heavy crankshaft, supported on three unusually large bearings; the simple, direct, splash oiling system, and the inherent smooth running qualities of the motor secured by the special method of timing.

The records of the G. B. & S. Motor in service leave no uncertainty as to the value of these four G. B. & S. features.

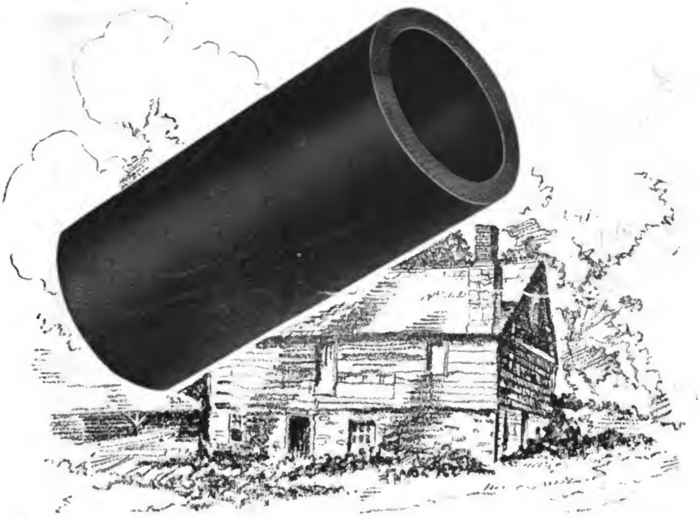
New Chain Adjustment

This feature, exclusive with the G. B. & S. motor, makes it possible to tighten chains on both magneto and generator in a few seconds. It is one of the simplest and most direct adjustments ever known. Write for details.

The fact that we build just one type of motor—have nothing else to sell—has many important advantages that will be perfectly clear to every pleasure car or motor truck builder.

If you are interested, write.

GOLDEN, BELKNAP & SWARTZ COMPANY
Detroit, Michigan



The Story of this Bearing Begins in an Old Mill, Two and a Quarter Centuries Ago

This old mill, illustrated above, was built in Radnor, Penna., about 75 years before the great American Revolutionary war began.

The bearings used were of *ordinary wood.*

Oiled continually for many years, these wooden bearings finally became so thoroughly saturated and impregnated with lubricant, that, thereafter, they needed no further oiling.

Month after month, year after year, for more than two hundred years, these wooden bearings remained in service.

This remarkable incident is responsible for NIGRUM *"Impregnated Wood"* Oil-less Bearings.

Continuous development and experimenting, extending over a period of 26 years, has produced a scientific oil-less wooden bearing, which, for certain uses, has distinct advantages over all other types and kinds of bearings.

NIGRUM *"Impregnated Wood"* Oil-less Bearings are made of carefully seasoned wood, specially selected for its toughness and hardness, then thoroughly impregnated by means of our patented process with our special lubricating compound.

Over two million NIGRUM bearings are now being sold annually.

A large number of these are used by Motor Car manufacturers in bearing places about a car that are difficult or impossible to keep properly lubricated.

For when this bearing is installed in a car it can be forgotten. It takes care of itself—oils itself. The heat of friction brings out the lubricant—the more heat, the more lubricant, just as it should be. A NIGRUM bearing will run without oiling or attention of any kind, a distinct advantage over all other bearings whose efficiency is dependent upon constant oiling and attention.

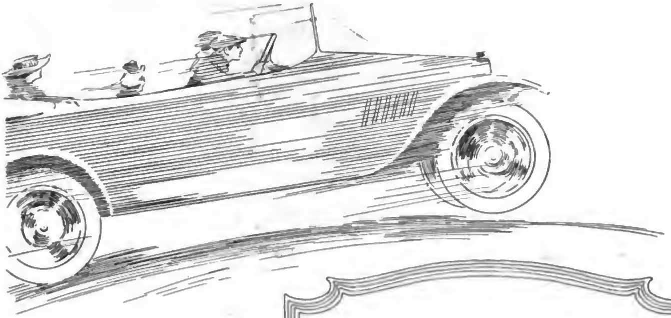
NIGRUM bearings remain cool and efficient in service, never squeak, and once installed can be forgotten.

Correspondence invited from manufacturers regarding their requirements.

BOUND BROOK OIL-LESS BEARING COMPANY

"Specialists in the manufacture of Oil-less bearings for more than a quarter of a century"

BOUND BROOK, NEW JERSEY



JOHNSON CARBURETOR

8-Cylinder—Special

Detroit s Own Carburetor

Eight Cylinder Cars Get Away Like a Shot

—leap ahead like a thoroughbred at the touch of the spur—get going with a sweeping rush that almost lifts the car off the road—if equipped with the new Johnson Special 8-Cylinder Carburetor.

From a walking pace up to the car's speed limit the flow of power is smooth, uninterrupted and accompanied with a remarkable satisfaction which comes from driving a car brimful of reserve power.

The unprecedented results obtained in this special 8-cylinder instrument can be attributed largely to the unique and exclusive fuel plunger construction which on starting or acceleration rushes a rich, powerful mixture to the motor, ensuring easy starting and preventing any letdown in the power curve upon "stepping up" to a higher speed.

For full particulars write

JOHNSON COMPANY

Manufacturers of Superfine Instruments of Carburetion

Detroit, Michigan

It's all in this unique fuel plunger construction

Simply asking for "A Spring" leads to spring breakage

Accept no substitute—insist upon

Tuthill Titanic Springs

No center Hole—No center Nib—No center breakage

Look out for substitutes

There is only one TUTHILL TITANIC Spring—it is not weakened in the center by a Nib or Center Bolt—it has the hump that you see in the illustration below—this makes it strongest where 75 out of every 100 springs break—and this is why we guarantee it forever against center breakage.

So why accept the "just as good kind" when you can get the genuine TUTHILL TITANIC at no higher cost?

In getting a spring replacement, insist on the TUTHILL TITANIC and see that you get it.

Ask for and get "Tuthill Titanics"

No matter what make of car you are driving, when a spring breaks you can have it replaced with a TUTHILL TITANIC which can be easily adapted to the axle construction of your car without any extra expense.

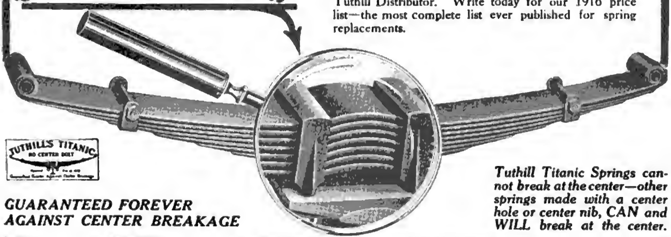
You can get a TUTHILL TITANIC anywhere—all leading dealers and garage men carry them in stock.

Learn the truth about spring construction—write today for our book "The SPRING that OUTLASTS YOUR CAR"—it is free for the asking and contains valuable, money-saving information you should know.

TUTHILL SPRING CO., 754 Polk St., Chicago, U. S. A.

See that Hump

Dealers: Selling TUTHILL TITANICS for replacements is both satisfactory and profitable. Ask us for name of your nearest Tuthill Distributor. Write today for our 1916 price list—the most complete list ever published for spring replacements.



TUTHILL'S TITANIC
NO CENTER BOLT

GUARANTEED FOREVER AGAINST CENTER BREAKAGE

Tuthill Titanic Springs cannot break at the center—other springs made with a center hole or center nib, CAN and WILL break at the center.

World's Record Ocean-to-Ocean Pathfinder 12 on "AMERICAN" Axles.

Speaking About Brakes

The American Ball-Bearing Co.,
Cleveland, Ohio.

Gentlemen:

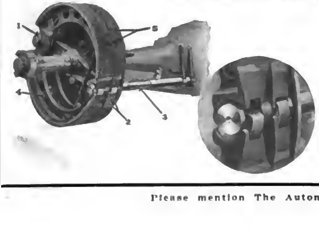
Pursuant to the telegram, which I sent you at the conclusion of the run, I am pleased to say that I experienced no trouble, either with the axles, brakes or bearings used on this car. You have every reason to feel enthusiastic about the twin internal brakes. During the 4,889 miles I did not have to adjust either the service or the emergency brakes. You must appreciate the fact also my not having a low or second gear in the transmission eliminated any chance of my using the compression of the motor as a brake in descending the hills.

As one mountaineer put it at Lucky Boy Mountain in Nevada, which is a 24% grade in places and has a very rough surface: "I don't doubt that the car will climb Lucky Boy Mountain because you have already come over some bad ones, but the drop on the other side of the mountain is 15 miles long, winding road and steep grades, which are very treacherous and you will have to use the compression of the motor on low gear to hold the car back."

However, in going down this hill I experienced absolutely no difficulty in holding the car. After disassembling the car in New York for the final A. A. A. examination made by Mr. H. A. Tarantous, member of the contest board, both the brake shoes were in perfect condition.

Yours very truly,
Walter A. Weidely.

American Axles



Quality and Design count in the brakes of "American" Axles, just as in all their other parts.

Licensed Under The Kardo Company's Patents

The American Ball-Bearing Co.

Pioneer Axle Builders of America

CLEVELAND, OHIO

Old English Wax

for Automobiles

Polishes
Protects
Preserves

Dealers: Send your letterhead for free full-sized can.

"Ten cents will put this fifty dollar lustre on your old car"

How you can bring back to life the "dead" finish in thirty minutes

Is your car so shabby that you are ashamed to ride in it any more?

It will cost $50 to paint it—besides laying it up during the best touring season of the year. So this is out of the question.

Why not try this? Send for a sample of Old English Wax. A little in ordinary cheese cloth—a swift application—once over—and a brisk short rub.

In thirty minutes a magic transformation will take place. Your old, dingy, rusty-looking car will glisten like new. Hood, fenders, body will shine with a brilliance you have not seen on them for months.

Keeps new cars from growing old

Old English Wax puts over the surface of your car a glass-hard, transparent shell that keeps out mud, dust, water, air and other lustre-destroying elements. If used at once on the new car it preserves indefinitely the original lustrous finish.

For floors, woodwork, furniture, linoleum, nothing equals Old English Wax.

Saves washing bills

Old English Wax dries so hard that dust can be wiped off after a day's run without harming the paint or enamel underneath. Think of the saving in washing bills alone that this feature effects. Moreover, Old English Wax can't collect dust, since it contains no non-drying liquids or oils. Absolutely guaranteed not to injure the finest finish.

Send coupon for sample and book

Sample will polish five-passenger touring car. Book is by Prof. David S. Pratt, University of Pittsburgh chemist. In it he tells about Oxidation, the destroyer of your car's finish, and why Old English Wax prevents this oxidation at the same time it polishes. Send 10c in stamps today to The A. S. BOYLE CO., 1922 Dana Avenue, Cincinnati, Ohio.

All good garages, accessory, hardware and drug stores sell Old English Wax

THE A. S. BOYLE CO., 1922 Dana Ave., Cincinnati, O.

Gentlemen: Please send me Prof. Pratt's book on automobile finish, together with a sample of OLD ENGLISH WAX FOR AUTOMOBILES. I am enclosing 10c in stamps (or coin) to cover cost of packing and postage.

Name..

Address..

City .... *State*......................

I buy my auto supplies from..

....

The Supreme Unit

In the U. S. Ball Bearing plant, the Inspection Department works independently of the Production Department. By that we mean that while each workman holds his work to certain specified limits, after he has completed his labors, the part is sent to the Inspection Department where it is carefully inspected independently of any inspection previously made.

As in all good manufacturing practice, this rigid inspection is made after each and every operation, upon each and every part which goes into the completed bearing and then the completed bearing is thoroughly inspected as an assembled unit before being shipped.

It is important to note that not only is our Inspection Department complete in every detail, but being of recent date, it is thoroughly equipped with the very latest devices known to manufacturing practice.

U. S. Ball Bearings are now manufactured in a plant capable of producing 10,000 high quality bearings daily.

U. S. Ball Bearing Manufacturing Co.
(Conrad Patent Licensee)
Palmer St. and Kolmar Avenue, Chicago

Photographs show new U. S. Ball Bearing factory and various stages of inspection

IGNITION

How Do You Consider It

Ignition is a puzzle to the majority of car owners — hence when ignition fails the car is useless and the owner becomes discouraged with his purchase—the car maker loses, the agent loses.

Has the car maker given as much thought to the ignition system as he might, has he tried to save money at the customer's expense, has he considered the many advantages of a good magneto, has he saved wisely by using something other than a magneto? These are questions; vital questions.

Ignition, being an absolute necessity, should be considered a part of the engine—just as much a part, and just as necessary as the crankshaft, a valve or a piston; it should be thoroughly dependable, and free from any influence of other parts of the car.

It should not be hitched to the lighting system or the starting system.

It should not depend upon the battery, which itself has to depend upon the dynamo and the possible thoughtfulness of the driver.

It should be free and alone.

Having Bosch Magneto Ignition, a car has reliable ignition, ignition that is world renowned, and that depends upon itself alone for its reliability.

Correspondence is invited on the ignition subject. Catalogues sent on request.

Bosch Magneto Company

**220 West 46th St.
New York**

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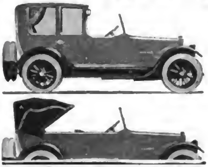
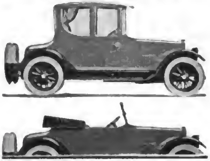
The ALL-YEAR Car Show

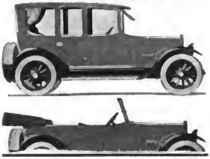
YOUR LOCAL KISSELKAR DEALER CORDIALLY INVITES YOU TO SEE HIS ALL-YEAR CAR DISPLAY, SEPT. 23RD TO OCT. 1ST.



The ALL-YEAR Car—Detachable Town Car Top mounted on HUNDRED POINT SIX five passenger Gibraltar Victoria Body and same car with Victoria Top. Price complete, $1,850.



The ALL-YEAR Car—Detachable Coupe Top mounted on HUNDRED POINT SIX Four-passenger Gibraltar Roadster Body and same car with top detached. Price complete, $1,520.



The ALL-YEAR Car—Detachable Sedan Top, mounted on HUNDRED POINT SIX Five-passenger Gibraltar Touring Body and same car with top detached. Price complete, $1,520.

Come!

SEE Kissel's original idea, The ALL-YEAR Car, in its highest form of development—*an innovation that changed the motoring habits of a nation*—

Bringing comfortable motoring in all seasons and weather with *one car*, while preserving the utility, style and completeness of two cars.

Here is an equal appeal to the requirements of the business men with an eye to utmost value and service, and to mother and the girls whose tastes demand beauty and refinement.

These three new, smart and aristocratic models of the ALL-YEAR Car can not be matched elsewhere, nor seen to better advantage than during ALL-YEAR Car Show Week at your nearest KisselKar Dealer's.

The Hundred Point Six

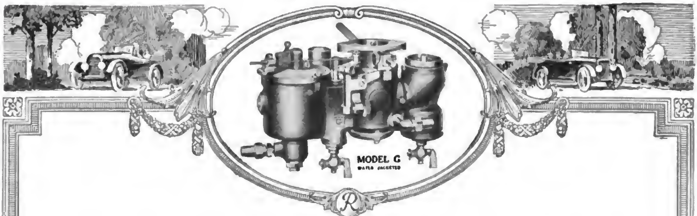
The car of a Hundred Quality Features that created a new standard of automobile value. ALL-YEAR Touring-Sedan, Roadster-Coupe and Victoria-Town Car—mounted on the famous *Hundred Point Six*—Prices $1520 to $1850. Open Touring and Roadster bodies without the ALL-YEAR Feature $1095.

Send for ALL-YEAR Car booklet just issued.

Kissel Motor Car Company
Hartford, Wisconsin -:- U. S. A.

DEALERS—The biggest opportunity in the retail automobile field is the All-Year business of supplying the demand for Kissel's ALL-YEAR Cars and the *Hundred Point Six*. Write us today for particulars.

The entire top—roof and all—is removable, insuring the obvious advantage of a wide open roofless car in summer. The top *fits in*—not on. No crude overlap at the joining point—no projecting fastenings inside or out to mar its appearance.



The owner whose car is equipped with a Rayfield is sure of Economy, Acceleration and Power with a Standard Adjustment

If your carburetor is a Rayfield, you *know* these facts. If your carburetor is *not* a Rayfield, you have it adjusted either for (1) *economy*, or (2) for acceleration and power. If it is tuned up for economy, it is weak in acceleration and power.

If adjusted for standard *power* with a richer mixture, you are wasting gasoline through the entire range.

RAYFIELD CARBURETORS

automatically furnish the additional supply of gasoline when needed for acceleration and extra power—*entirely independent* of the running mixture. Let it be adjusted for economy—it will give full power and will respond to any extraordinary demand for acceleration.

Rayfield Bulletin

* * * *

JEFFERY

(The Nash Motors Co.)

This splendid car is the latest addition to the Honor Roll of leading automobiles equipped with

RAYFIELD CARBURETORS

Owners of good cars not equipped with Rayfield consider it good judgment to substitute a Rayfield. That it is highest in price is only an added assurance of better performance. There's a Rayfield service station near *you*.

Findeisen & Kropf Mfg. Company
2117 Rockwell Street, Chicago

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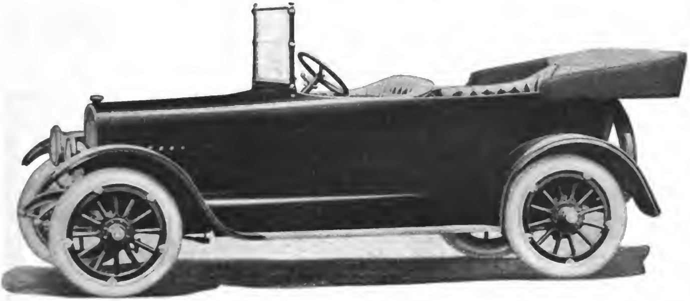
DETROIT

Here's a Car That Everyone Has Wanted



Regal-4-thirty-two

A car that everyone has wanted—

At a price that everyone has wanted—

Get in your mental comparison notes, go over this Regal-4-32 item for item, and then tell us if we're not right.

$695 is the price. 108 inches is the wheel base. The rear seat is 46 inches wide and has leg room to spare. Aren't we right when we call it the biggest car in its class on the 1917 market?

And the Regal-4-32 is just as generous as its equipment. Style—to the minute, as you can see by its lines; with comfortable wide doors and deep straight-grained glazed upholstery. There's a wealth of convenience, too, in its complete instrument-board on the dash, and the handy "velvet" gear-shift.

Best of all, the performance of the big motor of the Regal-4-32 keeps all the friends that it makes on its appearance.

Compare this with any car you like and figure how much easier this car ought to sell than any you have known. Then write us at once. Maybe we have a territory open that would please your requirements.

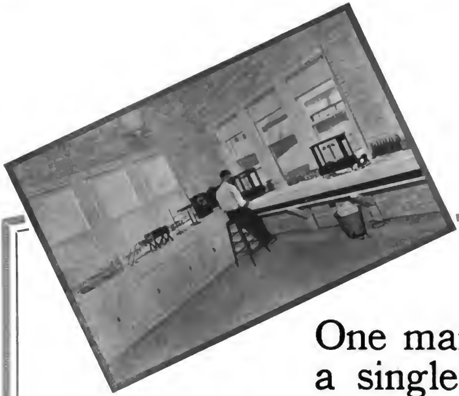
$695

Detachable head motor, 3⅛" bore, 4½" stroke, 32 h.p.
Cantilever springs.
2 unit starting, lighting and ignition—magneto type.
Gasoline tank at rear—vacuum feed to motor.

REGAL MOTOR CAR COMPANY

(DEPT. C)

DETROIT. MICHIGAN



AGATHON STEELS TRADE MARK ©

One man with but a single thought

His whole attention is concentrated upon analyzing or testing the materials which enter into the making of

AGATHON STEELS

We have placed at his disposal the very finest equipment which money can buy and the quarters in which he works are conducive to the very best there is in him. Therefore, only one thought need enter his mind and to that he can give his entire attention.

In picking the man we have picked the best we can find, and can truthfully say that when Agathon products have passed the analysis and tests to which they are subjected in this laboratory, they are as near perfect as human hands can make them.

OUR PRODUCTS

"Agathon" Chrome Nickel
"Agathon" Chrome Vanadium
"Agathon" Nickel Steels
"Agathon" Special Analyses
"Agathon" Vanadium
Shipping Facilities—3 Railroads
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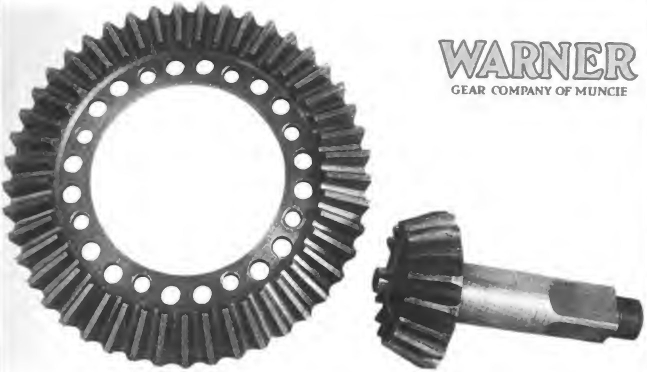
WARNER
GEAR COMPANY OF MUNCIE



Warner Gears Win Many Victories for Dario Resta

The picture is an unretouched photograph of the *Warner* differential drive gears made for Dario Resta, and which have driven his car to many prominent victories in the greatest races in the country during the past twenty months.

The gears, even at the close of thousands of miles of grinding service at high speeds, are practically in perfect condition.

Success, as a race driver, depends absolutely on the staunchness of the driver's car in every detail, and Resta's supreme faith in *Warner Gears* is a distinct compliment which should have a meaning to every car owner.

Is This High Quality Built Into Your Car?

WARNER GEAR COMPANY, Muncie, Indiana
Detroit Office: 967 Woodward Avenue

Open Car Freedom—Closed Car Luxury Combined—at Moderate Prices

These two new Overlands are the first full size Touring Sedans ever offered to the public at moderate prices.

Such cars at such prices are possible only because of the economies made possible by our enormous production.

And they fill a long-felt want.

Undoubtedly the car that is both an open touring car and a closed sedan, easily convertible on the instant, is the ideal family car for year-round every purpose use.

Such cars at $1195 for the four and $1325 for the six—both roomy five passenger cars—are heretofore unheard-of values.

Closed, these cars afford perfect protection against cold, wind, rain or snow.

When open they are free to every friendly breeze that blows.

The change can be made either way easily and quickly and with no more effort than it takes to raise or lower the windows.

And, either open or closed, these cars are beautiful in appearance—have lots of style—are absolutely free from the suggestion of makeshift which is so apparent in separate sedan tops for touring cars.

But there are many other features to commend these cars, in addition to their perfect convertibility.

The four has the 35 horsepower motor which has made the Overland famous for years—in its latest improved en bloc type.

The six has a 40 horsepower en bloc motor with wonderful flexibility and lightning pick-up.

Cantilever rear springs make both cars remarkable for their easy riding qualities.

And long wheelbase—the four 112 inches the six 116 inches—and four and one-half inch tires add further to their riding comfort.

See these new cars at once.

You will be amazed that such beautifully finished, luxurious Touring Sedans can be built to sell at such low prices.

See the Overland dealer before it is too late to get an early delivery.

Specifications

Motors—en bloc type—The Four, 35 horsepower—the Six, 35-40 horsepower

Wheelbase—The Four, 112 inches—The Six, 116 inches

33 x 4½ inch tires—non-skid rear
Gasoline tank and gauge at rear
Auto-Lite starting and lighting system
Cantilever rear springs
Richly carpeted floor
Electric control buttons on steering column
Vacuum tank fuel feed
Improved seat springs
Divided front seats with wide aisle between
Attractive cloth upholstery
Interior dome light

The Willys-Overland Company, Toledo, Ohio

"Made in U. S. A."

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The AUTOMOBILE

Maud L'Anpnere Crook

Vol. XXXV
No. 16

NEW YORK, OCTOBER 19, 1916

Ten cents a copy
Three dollars a year

The Unseen Source of Power

Unseen, but vitally important, is the source of power in automobile or motor truck. All else in the construction has its due importance, but for the owner it's the motor that makes the car.

In over 250 models of pleasure cars and trucks, the Continental Motor is under the hood. Powerful but quiet, responsive yet sturdy, with speed only short of a racer's, with economy beyond one's expectation, this motor brings the look of gratified content to the owner's face. Both by such silent tokens and by their oft-spoken praise, hundreds of thousands of car owners indicate their pride in their Continental Motors.

Thus has the Continental Motor earned its widespread reputation as America's standard motor. The uniform satisfaction of owners—this truly is its unseen source of power.

CONTINENTAL MOTORS COMPANY
OFFICES: Detroit, Mich.
FACTORIES: Detroit, Muskegon

Largest exclusive motor manufacturers in the world

Continental Motors

Over 1,500,000 Prospects

Every car needs a Stewart Vacuum System. Every manufacturer concedes this. The public is realizing it more and more every day.

In spite of the tremendous tank business we are now doing, still there are 1,500,000 cars in use that have not been equipped with the Stewart Vacuum System.

That's your market, Mr. Dealer:

Get busy.

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart
Vacuum System

$10

LARGEST STOCK IN THE UNITED STATES of

ALUMINUM AUTOMOBILE BODY SHEETS

In Stock Ready for Immediate Shipment

16 B. & S. Ga. . . 36 x 144 . Medium Temper
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We have also a complete stock of all other sheets. A request will bring our stock list.

United Smelting & Aluminum Co.

New Haven - - - - Conn.
24 Stone Street - - New York City
Penobscot Building - - Detroit, Mich.

Aitken Breaks World's Record for 250 Miles, Averaging 104.83 M. P. H., Winning Astor Cup Race, Sept. 30, Rickenbacher Second. Both Use

Oilzum

Resists the Heat, Remains and Lubricates Longer and Better, Increases Power, Induces Smooth, Quiet Running, Reduces Oil Consumption, Prevents Smoke and Minimizes Carbon Troubles

Send for Booklet "CRYSTAL CLEAR" and Attractive RACE POSTER

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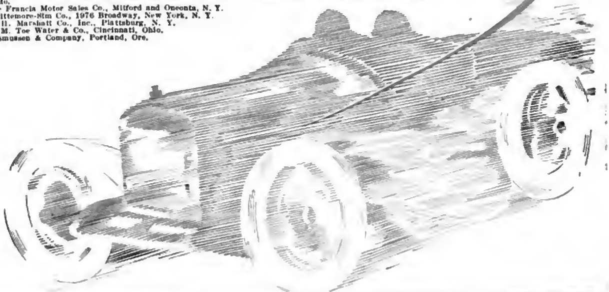


The AUTOMOBILE
THE CLASS JOURNAL COMPANY
231—241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, OCTOBER 19, 1916 No. 16

Important Trade News of the Week............................641-651

Editorials 652

Resta Wins 250-Mile Grand American............................ 653

Value of Rating Formula Limited................................ 656

Willys-Overland's New Headquarters............................ 660

Automobile Conditions in Europe................................ 662

Moline Makes Engine Changes.................................... 664

Commerce Adds 1-Ton Model...................................... 666

Fuel Feed by New Method.. 668

Studebaker Custom Bodies....................................... 670

Eliminating Glare Is Easier.................................... 674

The Rostrum.. 676

- Continental Engine in 1917 Overland
- Engine Needs Thorough Overhauling
- Finding Differential Gear Ratio
- Information on Nitrogen Filled Bulbs
- Lubrication Is Provided on Grades
- 55,000 Wire Wheel Cars in 1916

Accessories 678

Industrial Miscellany.. 682

Index to Advertisers..........96-97

QUALITY

When you adopt "NORMA" - equipped magnetos, lighting generators and starting motors as your standard car equipment, you are simply introducing an element of dependability which will improve the serviceability of your car and add to its saleability.

Have You the Catalog?

(Patented)
"NORMA"

SERVICE

Why I am a Studebaker Dealer

I am selling Studebakers because I thoroughly believe in them. I know them to be the best value on the auto market today. I wanted a car that I could represent without the necessity of assuming an apologetic and explanatory attitude towards my friends and the public in general—in other words, a car of which I could be proud. I wanted this not only for my own peace of mind but for the psychological effect it would have on my selling campaign—for I knew that if I did not respect and was not proud of my car I could not push its sale with whole-hearted zeal, and that my selling campaign would lack in enterprise and punch.

That's the reason I'm selling Studebakers.

James Nixon

Nixon Motor Car Co.,
Hollywood, Cal.

SO you see pride in a Studebaker car is not necessarily limited to owners. The dealer, too, looks upon it as something more than a mere source of revenue. It is a sort of a sign or symbol by which he publicly declares his judgment of quality and value in a motor car. And, of course, his success is measured by that standard.

Today there are more than 6500 dealers throughout the country who are selling a total of Studebaker cars greater by far than that produced by any manufacturer of medium-priced quality motor cars.

If that isn't an indication of quality, value and superior performance—what is? We've got some interesting dealer facts. Are you interested?

STUDEBAKER
Detroit, Mich.
South Bend, Ind. **Walkerville, Ont.**
Address all Correspondence to Detroit

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, OCTOBER 19, 1916—CHICAGO NO. 16

Brown-Lipe-Chapin Co. Sold

United Motors Buys Biggest Maker of Differential Gears in America

NEW YORK CITY, Oct. 16.—The Brown-Lipe-Chapin Co., Syracuse, N. Y., largest manufacturer of differential gears in America, has been purchased by the United Motors Corp. and the same policy with regard to the Brown-Lipe-Chapin Co. will be followed as is used by the United Motors Corp. with the several other concerns it has purchased. President Alfred P. Sloane, Jr., of the United Motors Corp., is authority for the statement that the general policy of Brown-Lipe-Chapin will be continued as at present but that the capacity of the plant in the manufacture of differentials will be doubled as soon as additional buildings can be erected. The large resources of the United Motors Corp. will give a broader foundation and scope to the Brown-Lipe-Chapin Co., and it is hoped to be able to manufacture differentials for all concerns needing them. President Sloane's name will be added to the board of directors of Brown-Lipe-Chapin, but H. W. Chapin will continue as general manager as he has in the past.

The purchase of the Brown-Lipe-Chapin Co. does not in any wise involve the Brown-Lipe Gear Co., of Syracuse, and which to date has been very closely connected with Brown-Lipe-Chapin. The Brown-Lipe Gear Co. is practically controlled by Messrs. Brown and Lipe, both

(*Continued on page* 650)

Moore Heads Western Spring Sales

NEW YORK CITY, Oct. 14—Kirk Moore has been appointed general sales manager of the Western Spring & Axle Co. For some time Mr. Moore has been production manager of the Vim Motor Truck Co., Philadelphia, previous to which time he was sales manager for Weston-Mott and Northway motors. The Western Spring & Axle Co. comprises the Cleveland Axle Mfg. Co., Canton, Ohio; Cleveland-Canton Spring Co., Canton, Ohio; Hess-Pontiac Spring & Axle Co., Pontiac, Mich.; Hess Spring & Axle Co., Cincinnati, Ohio; J. B. Armstrong Mfg. Co., Flint, Mich.; Cincinnati & Hammond Spring Co., Cincinnati, Ohio; Amsted Spring & Axle Co., Connersville, Ind.; Spears Axle Co., Wheeling, W. Va.; Champ Spring Co., St. Louis, Mo.

Coffin on Defence Commission

NEW YORK CITY, Oct. 12—President Wilson has named seven members of the Advisory Commission, associated with the Council of National Defense to study and suggest methods of increasing industrial and military efficiency of transportation and manufacture of munitions of war. The automobile industry is represented by Howard E. Coffin, other members being Daniel Willard, president of the B. & O., Samuel Gompers, President of the American Federation of Labor, Dr. Franklin H. Martin, Bernard Baruch, Dr. Hollis Godfrey and Julius Rosenwald.

King to Raise Car Prices

DETROIT, MICH., Oct. 15—The King Motor Car Co. will soon increase the price of its cars to take effect in about 60 days. The firm states it will soon be impossible to manufacture an automobile of the quality of the King eight-cylinder type to retail at $1,350.

Standard Parts Co. Merger Name

CLEVELAND, OHIO, Oct. 15—The corporation to be formed by the consolidation of the Perfection Spring Co. and Standard Welding Co. may be known as the Standard Parts Co. Seven per cent cumulative preferred stock may be offered at par or very close to that figure in the near future.

G. M. Corp. Capital $102,600,000

Readjustment Plan Approved —$82,600,000 Common and $20,000,000 Preferred

NEW YORK CITY, Oct. 16—The final organization of the new General Motors Corp. which has been effected under Delaware laws, reveals that the authorized capital stock will be $102,600,000. The formal approval of the readjustment plan which was first made public in THE AUTOMOBILE for Sept. 28 has been given by upward of 70 per cent of the holders of outstanding stock and has been forwarded to the shareholders of the General Motors Co. The plan has been signed by every member of the board of directors except J. A. Haskell, who is in Europe.

Readjustment Plan the Same

The readjustment plan is the same as was first made public. Of the total capitalization $82,600,000 is common stock and $20,000,000 is non-voting preferred stock, all shares having a par value of $100. The preferred stock is entitled to receive cumulative dividends at the rate of 6 per cent and is subject to redemption at the option of the company at $110 on Nov. 1, 1918, or any subsequent dividend date.

The distribution of stock in the Delaware corporation remains unchanged, shareholders of the General Motors Co. of New Jersey having the privilege of exchanging each share of preferred stock for one and one-third shares of new preferred stock, and one share of common stock for five shares of the new common stock. Deposits for exchange are to be made with the Guaranty Trust Co., New York, between Oct. 15 and Dec. 16 inclusive. The readjustment plan becomes effective Nov. 1.

Accessory Space Allotted

Stiger Succeeds Lovell as Assn. Pres. and Bradley Takes Sweet's Place

NEW YORK CITY, Oct. 14—Eighty-seven accessory concerns have been allotted space at the national shows in this city and Chicago. After adding sixteen concerns which will exhibit in this city only, the New York total thus far reaches 103. Twelve concerns will exhibit only in Chicago, thus making the total number to date there, ninety-nine. Last year New York was given eighty-seven and Chicago, eighty-three.

A meeting of the show and allotment committee of the Motor and Accessory Manufacturers was given yesterday at which space was given to 115 members, compared with ninety-five last year.

Several new companies will exhibit at these shows this year, including the following: A. B. C. Starter Co.; Au-To Compressor Co.; Detroit Weatherproof Body Co.; Evapco Mfg. Co.; Ferro Machine & Foundry Co.; Hall-Thompson Co.; Kokomo Electric Co.; Leather Tire

(*Continued on page* 681)

Olympian Motors Co. Formed

PONTIAC, MICH., Oct. 17—The Olympian Motors Co., this city, has been organized to build an automobile selling at less than $1,000. R. A. Palmer, prominent in the business activities of the Cartercar company, will head the new company and he will have associated with him as executives G. C. Bull, treasurer; C. E. Callender, secretary; and A. M. Stryker, advertising manager.

McClure Tire & Rubber Co. Formed

COLUMBUS, OHIO, Oct. 14—The McClure Tire & Rubber Co., which has been in business for about 3 years in East Gay Street, has been incorporated with J. A. McClure, Jr., president; E. Buchanan, vice-president, and Robert McClure, secretary and treasurer. A lease has been taken on a new building now in course of construction at 214-218 East Gay Street.

Thompson Is Miller Advertising Director

AKRON, OHIO, Oct. 14—C. S. Thompson has been appointed advertising director of the Miller Rubber Co., this city. Mr. Thompson was formerly president of the Thompson-Carroll Co., Cleveland.

Hutchinson Overland Branch Manager

TOLEDO, OHIO, Oct. 14—Guy Hutchinson has joined the Willys-Overland Co. to act as branch manager for Willys-Overland, Inc., New York City. Mr. Hutchinson was formerly sales manager and treasurer of the firm of Hart & Hutchinson.

G. M. Graham will assume the position of research and publicity manager for the advertising department of the Willys-Overland company on Nov. 1. Mr. Graham was formerly the sporting editor and automobile editor for the Philadelphia *North American.*

Manhattan Electrical Supply Reorganized

NEW YORK CITY, Oct. 14—The Manhattan Electrical Supply Co., this city, maker of the Red Seal battery, which was recently reorganized with an issue of $1,500,000 first preferred, $500,000 second preferred and $3,000,000 common, reports that all of the 7 per cent first preferred stock issued has been purchased.

Organize Truck Holding Co.

DETROIT, MICH., Oct. 13—Organization of a holding company in New York to be known as the United Truck and Equipment Co., with incorporation in Michigan, to operate the United Motor Truck Co., is being perfected. Other companies may be controlled by the holding company, possibly including the Republic Truck Co., Alma, Mich.

Capitalization of the new company will be more than $400,000, and it is understood that $60,000 or more will be stock without par value or practically common stock.

New Auto Parts Corporation

DETROIT, MICH., Oct. 14—The Canton Auto Parts Mfg. Co., Canton, Ohio, has been organized and incorporated with a capital stock of $300,000 to manufacture all kinds of automobile parts. S. S. Kurtz who is vice-president of the McCaskey Register company of Alliance, Ohio, and J. M. Kurtz are the principal stockholders. The company will be ready for operation about Oct. 24.

Eisenberg Is Scripps-Booth Engineer

DETROIT, MICH., Oct. 17—H. O. C. Eisenberg, formerly engineer of the S. G. V. Co., has been appointed chief engineer of the Scripps-Booth Corp., succeeding Charles A. Ericston, who has resigned.

Kopf Opens Chicago Office

CHICAGO, ILL., Oct. 16—M. G. Kopf has opened an office at 620 Chemical Building, Chicago, and will specialize in chemical electrical lines as applied to automobile engineering and patent matters. Mr. Kopf was formerly chief engineer of the McCormick Laboratories, Dayton, Ohio.

Lenox Co. To Make Tractors

Two Models at $4,500 and $2,000 Respectively—Passenger Cars Continued

HYDE PARK, MASS., Oct. 9.—Two tractors, one selling for $4,500 and the other for $2,000 represent what the Lenox Motor Car Co., with a plant at Hyde Park, Mass., is now building. They are to be known as the Lenox-American tractors. They will not interfere with the building of automobiles. The tractors were designed by R. B. Morton, whose father built the first ones made by the International Harvester Co. Additional capital has been brought into the company, President Howard having resigned from a big shoe concern to take the presidency.

The Lenox-American large tractor weighs 12,500 lb. The two big features of these tractors are the four wheel drive and four wheel steer. Self starters are a third. There is a three-speed transmission, patented worm and sleeve clutch and the same lever that operates the clutch also operates the brake. Another good feature is the control lever that takes the place of the governor. This little lever drops into a notch and takes up the speed of the engine. The operator steers the axles, not the wheels. The big tractor was made to turn in a circle the inner diameter of which was less than its own length of 16 ft. The steering gear is not of the ordinary cast type, but is worm and gear run in oil. The drive chain performs like a belt.

Axles are semi-floating and packed in grease. The power is transmitted direct from the driving axles to the face of the four lightweight drive wheels by pull rods so that none of the driving strain comes on the spokes. The wheels of the big tractor are 60 in. high, with 18 in. face, and the smaller are 48 by 10 in.

Two levers control the tractor. One is used solely to shift gears. With the other first the clutch is released, then the throttle closes and last of all the brake is applied. On the reverse motion of this second lever the brake is released, engine speeded up and the clutch engaged.

The company plans to build about 300 of the tractors the first season.

Wilson Takes Over Sales Duties

DETROIT, MICH., Oct. 17—George D. Wilson, production manager of the C. R. Wilson Body Co., has also assumed the duties of sales manager. Charles F. Barth has been appointed works manager of the company.

Crankshaft Corp. Issues Stock

2500 Shares 7 Per Cent Preferred and 7500 Shares of Common

DETROIT, MICH., Oct. 16—The Automobile Crank Shaft Corp., which recently absorbed the business of the Auto Crank Shaft Co., has authorized the issue of stock amounting to $250,000, which is divided into 2500 shares of 7 per cent cumulative preferred stock, par value $100, and 7500 shares of common stock of no par value.

According to a statement issued by James M. Hibbard, secretary and treasurer of the corporation, the company will manufacture 72,000 crankshafts this coming year, which is less than one-third of the business offered, the records showing that, because of limited capacity, the company was forced to refuse 153,000 shafts.

Provision is now being made to at least double the capacity of the plant by February, 1917. Present customers include over twenty-five of the most prominent concerns in the automobile industry among whom are Studebaker, Stutz, Stearns, Winton, Peerless, National, Mercer, Locomobile, Hupp and Cadillac.

The net earnings of the company are 300 per cent in excess of those of 1914 and equal to eight times the maximum amount of dividends upon the preferred stock. The directorate includes among its members: A. R. Demory, vice-president of the Timken-Detroit Axle Co., and Henry H. Sanger, vice-president of the Hayes Mfg. Co.

AUTOMOBILE CRANKSHAFT CORPORATION STATEMENT FOR 8 MONTHS ENDING AUG. 31, 1916:

Assets		
Land and buildings......		$56,397.85
Equipment, tools, furniture, fixtures and machinery		186,672.63
Less reserve for depreciation	$2,938.58	
Work in process (labor and overhead expense).		16,845.20
Factory materials and supplies		6,748.37
Accounts receivable (customers)		70,719.27
Less reserve for doubtful accounts	16,323.40	
Insurance premiums unexpired		100.12
Prepaid taxes		1,444.96
Total assets..........		$342,878.79
Liabilities		
Preferred stock—7 per cent cumulative—2500 shares, par value $100		$250,000.00
Balance represented by 7500 shares of no par value common stock..		65,565.41
Accounts payable—trade creditors.		18,391.99
Bills payable		None
Accrued salaries and wages.......		7,431.74
Accrued liability insurance........		486.41
Reserve for Federal income tax...		1,000.00
Total liabilities................		$342,878.79

Woodruff Is Simplex Sales Manager

NEW YORK CITY, Oct. 18—A. A. Woodruff has been appointed sales manager of the Simplex Automobile Co., succeeding R. M. Barbour, resigned. Mr. Woodruff joined this company this year as manager of the body department. Later he became assistant sales manager. He has been in the automobile field since 1900, when he formed the Woodruff Mfg. Co., to build automobile bodies, later becoming connected with the E. R. Thomas Motor Co., later becoming producing manager. In 1912 he became eastern sales manager American Motors Co. and the Lexington-Howard Co. as manager.

Henry Splitdorf Dead

NEW YORK CITY, Oct. 17—Henry Splitdorf, inventor of the magneto bearing his name, died in his home in this city yesterday at the age of eighty-two. His eldest son, C. F. Splitdorf, is head of the Splitdorf Electrical Co., Newark, N. J.

Mr. Splitdorf was a native of Germany. He was the pioneer of telegraph instrument makers, having made them for Professor Morse, the inventor of telegraphy. Mr. Splitdorf was the inventor of the liquid insulation of the magnetic wire.

Agnew Directs Chalmers Advertising

DETROIT, MICH., Oct. 17—W. L. Agnew, who resigned as advertising manager of the Hudson Motor Car Co. some few months ago, to accept the position of assistant manager of the sales promotion department of the Chalmers Motor Co., has been appointed advertising and publicity director of the Chalmers company.

Tisch to Make Dean Knife Timers

DETROIT, MICH., Oct. 13—The Tisch Auto Supply Co., Grand Rapids, has purchased the Dean Knife timer for Ford car rights and will manufacture them under the supervision of W. B. Dean.

Pa. S. A. E. Meets Oct. 26

PHILADELPHIA, PA., Oct. 14—The first meeting of the Pennsylvania Section of the Society of Automobile Engineers for the season of 1916-17 will be held at the Engineers' Club, 1317 Spruce Street, Philadelphia, on Thursday evening, Oct. 26. Herbert Chase, chief engineer, Automobile Club of America, will speak on "The Otto Cycle versus Constant Pressure Cycle For Automobile Engines."

This meeting will be the last of the current administration year and the annual election of officers will be held.

Doble Paper on Steam Automobile

CLEVELAND, OHIO, Oct. 13—Abner Doble, designer of a steam automobile bearing his name, will deliver a paper before the local section of the Society of Automobile Engineers on Oct. 20, covering his work on the steam car.

S. A. E. To Discuss Aluminum

Paper By J. E. Diamond Treats Exhaustively on Use for Automobiles

NEW YORK CITY, Oct. 18—A paper entitled, "Aluminum and Its Use in Modern Aeroplane Motor and Motor Car Construction," will be read by James E. Diamond before the Metropolitan section of the S. A. E. here to-morrow night at its opening session of the season. Mr. Diamond is consulting engineer, Aluminum Castings Co., Cleveland, Ohio.

The introduction to Mr. Diamond's paper touches upon the abundance of aluminum, pointing out that aluminum in nature is more abundant than any other metal and that it constitutes approximately 8 per cent of the earth's crust. The discovery of aluminum is touched upon, this happening shortly after the beginning of the nineteenth century. Mention is made of the progress made in the methods of reduction from time of Woehler to the year 1886, when electricity was first utilized in reducing the ores of aluminum.

The metallurgy involved in the reduction of aluminum by the process invented by Charles M. Hall is briefly sketched.

Some little space is devoted to a discussion of the physical properties of aluminum. The alloy field is covered briefly. The foundry likewise comes in for attention. The very great care necessary in the production of successful castings is touched on at some length. Such factors as furnace temperature, pouring temperatures are touched upon. A statement is made that there is probably no one factor of vital importance than the pouring temperature and "that casting which is barely escaped being a mis-run in the finished section due to a low pouring temperature is the best casting from all standpoints. Explanation for this is given. The need for supervision by technically trained men in every stage in the evolution of a casting is emphasized very strongly.

The employment of aluminum castings in motor car and also aero motor construction is considered. The employment of aluminum castings almost invariably for the larger units in the motor car is mentioned. These parts are, of course, the crank and transmission cases. The employment of the former in all cases where the cylinders and and crankcase are not cast integral is characterized as standard since only in one or two instances is material other than aluminum used for the case.

Regarding the transmission case, cost is cited as the only reason for the non-

(*Continued on page* 651)

Accept Four S. A. E. Standards Reports

Standards Committee Approves Miscellaneous, Tire, Aeronautic Engine and Truck Control Reports—Headlight Glare and Military Truck Specifications Feature Discussions

Special to THE AUTOMOBILE

WASHINGTON, D. C., Oct. 18—Meeting to-day at the Bureau of Standards, the standards committee of the S. A. E. received reports from nine divisions and placed several new standards on the books for presentation to the Society for mail vote.

Conspicuous are recommendations regarding headlamps, the final report of the research division on the standard form for fuel economy and acceleration testing, revised testing forms for use in determining engine performance and standard controls for trucks.

Dr. Stratton, in his address of welcome, urged that the S. A. E. make full use of the facilities of the Bureau of Standards for tests and research and made a strong plea for the adoption of metric standards wherever possible.

Speaking of standardization in general, he congratulated the society on being in a new field and able to profit by experience in older fields. He stated that co-operation between practical and scientific men is necessary in working out standards and emphasized the value of scientific testing to intelligent standards work. He also urged uniform international units of measure in both scientific and practical fields. He considers the metric system best and believes that a change to that system is not so difficult or expensive as many believe. Dr. Stratton cited the Bureau's work on porcelain in spark plugs as an instance of its value to the automobile industry, determining physical properties of porcelain and investigating refractories. He asked for suggestions for co-operative work by bureau.

The Morning's Work

In the morning the reports of those divisions on which little discussion was anticipated were taken up. B. D. Gray, Hess-Bright Mfg. Co., chairman of the ball and roller bearings division, presented a report standardizing medium series, one direction ball thrust and recommending standard stock sizes for aeroplanes instead of special sizes.

Another report presented during the morning was by Henry Souther, chairman of the recently formed aeronautic engine division. This recommended adoption of the European taper propeller soft end which the U. S. Army and Navy has adopted. It is now used on the Hispano-Suiza engine by Simplex. This was opposed by C. M. Manly, Manly Drive Co., on the ground that improvements will be made too soon to make standardization worth while. Mr. Souther proposed standardizing the 18-mm. plug for aeroplane engines as the S. A. E. plug does not stand up under severe punishment for some unknown reason. The matter is now being studied. He also advised the adoption of the electric motor definition of engine rotation and reported progress on horsepower per pound ratings.

Mr. Souther's report was accepted with the amendment that the taper shaft end be held in abeyance.

Colonel Squier, in charge of the aviation section of the U. S. Army, spoke on the advantage of close co-operation between the engineers and the government department, saying that America wanted to avoid Europe's mistakes in aeroplane engines and plane specifications.

Augustus Post, of the Aero Club of America, announced that a Pan-American Aeronautical Exposition will be held at the Grand Central Palace, Feb. 8 to 16.

Standard sizes for battery jars have been under consideration by the electric vehicle division for some time, and agreement is not yet reached, so this division presented only a progress report showing that the subject is likely to be cleared up finally before the Winter meeting.

Chairman Whitney reported progress to reduce battery jar sizes from 200 to 41 with 32 in one height, 9 in another and lamp sizes from a host to nine, all one base type, three sizes, and three voltages. Progress on rubber tire efficiency tests and sizes of charging cables is waiting for reports from other electrical societies on cables.

Miscellaneous Report Accepted

A very excellent report was presented by J. G. Utz, consulting engineer Perfection Spring Co., and chairman of the miscellaneous division. This division has a very full program and a number of difficult subjects before it. The report contains only two new recommendations in final form, one relating to spark plug terminal thread and the other to the extension of rod ends.

The division recommended that 15/16-in. hex size for spark plugs replace ⅞, as many makers now use it because it allows greater porcelain thickness while the same spanners fit it. Terminal threads should be in two sizes, 5-40, Ford size, and 8-32 as the S. A. E. standard, the 8-32 to be the A. S. M. E.

A taper socket and plug for fender irons in thread sizes from 7/16 to ¾, all tapered 4½ in. per foot, was also presented. The division also submitted two standards for steering wheel hubs, straight for those with levers on the top of the wheel and tapered for those not at the top. There are four sizes of each, ⅞, 1¾, 2, 2¼, taper of 1 in. per foot. It was also recommended that no extension of rod ends beyond ½ in. be made, as the larger sizes are not needed for strength, but only for wear, which can be provided on smaller sizes by hardening the pins. Mr. Utz's report was adopted.

Tire Division Recommendations

The tire division recommended straight side tires from 32 by 3½ to 36 by 4½, as the larger straight sides are not practical. The smaller ones are on Fords and therefore the soft bead clinches. J. E. Hale, experimental engineer of Goodrich Tire & Rubber Co., amended this recommendation with a provision that straight sides be of the wide standard. The report was adopted.

Prof. Gallup's report on Proposed Standard Form for a Complete Car Performance Test was presented. This was only a progress report for the research division and will be final in January. The report follows:

Proposed Standard Car Performance Test

1—The entire test shall be made upon an automobile speedway or other course surfaced with wood, brick, concrete, asphalt or an equivalent material. Such speedway or course must have been approved for this purpose by the Council of the S. A. E. or an agent authorized by it.

2—The entire test shall be conducted by a competent and impartial referee approved by the Council of the S. A. E. This referee shall have complete charge of the test and he shall select such assistants as he may deem necessary. The referee shall certify to the results of the test before a notary public, who shall affix his seal thereto.

3—The entire test, including the fuel economy runs and the acceleration runs, shall be performed between sunrise and sunset of the same day.

4—The entire test may only be run at a period during which no appreciable wind exists, i. e., no wind which at any time exceeds a velocity of 15 m.p.h., measured at the nearest U. S. weather bureau station. The average values of humidity and barometer shall be obtained from the same source.

5—During the entire test the car must be run with all tanks full and carrying its full complement of passengers or corresponding ballast. Full complement of passengers shall consist of one passenger or the equivalent for each seat provided, driver included. The average weight for passengers and driver is to be 150 lb. each.

6—During the entire test there must be no change in gear ratio, ignition, carbureter, or any other detail of the car or its equipment. This shall not be interpreted as prohibiting changing spark plugs or manipulation of spark and throttle levers.

7—When a car is stated to be a stock

car it must be stock in every particular. Even though different carburetors, ignition systems, gear ratios or other details are optional on the same stock car, no change shall be made during the entire test.

8—A car fitted with an inclosed body must have all windows and doors closed during the runs.

9—A car fitted with an open body must have the top up and windshield fully erected during the runs. Rear curtains must be fastened down. Side curtains must not be used.

10—The pressure in the tires shall be that recommended by the manufacturer of the tires used, corresponding to the load applied both front and rear.

11—The highest gear only is to be used during the entire series of runs.

12—At no time during the runs shall coasting, declutching or the use of brakes be permitted.

13—Oils and greases used in the engine, transmission, rear axle or other parts of the car must be of usual quantity and quality.

14—The whole of the fuel used during the test must be of one quality. A sample of the fuel shall be taken for the purpose of determining and recording its specific gravity. The trade name of the fuel used shall be given. Wherever possible, information relative to its heat value shall be furnished, also a curve showing the results of a fractional distillation test.

15—All fuel used during the test must be fed from the special tanks placed on the windshield. (See description of apparatus under Fuel Economy Runs.)

16—Previous to beginning any run of the test, the engine is to be operated sufficiently long to bring it to the normal temperature corresponding to the conditions existing during that run.

17—The entire cooling system must be fully operative during the test, both as regards air and water circulation.

18—From the beginning to the conclusion of the entire test (including both the acceleration and economy runs) there shall be no manipulation of any carbureter adjustments or control other than the throttle.

Fuel Economy Runs

19—The fuel economy runs, when conducted upon a speedway, shall be made so as to complete each run at a point identical with that of starting. Each run shall be made without any interruption.

20—When conducted upon a course approximately straight, the runs shall be arranged so that each shall be completed at a point identical with that of starting. In each run there shall be no interruptions except those necessary for turning. Any such course shall have an exact length of 5, 2½ or 1 2/3 miles in one direction.

21—The fuel consumption shall be measured at a series of speeds covering the entire range of the car from the minimum to the maximum, following in general the outline in the table:

Run	M.P.H.
1	Minimum speed
2	9-11
3	14-16
4	19-22
5	26-30
6	35-40
7	47-55
8	63-70
9	Maximum speed

Note: In case the maximum speed is less than that indicated in any of the other runs the latter shall be omitted from the test. In any event, however, a run is to be made at the maximum speed of the car.

22—Fuel shall be fed to the carbureter during the runs by gravity and shall be supplied from a weighing tank mounted so that the actual distance between the top of the float chamber of the carbureter and the bottom of the fuel chamber is not less than 12 in. The tank shall be such that the variation in head during a run shall not exceed 12 in.

23—There shall be two tanks, preferably mounted side by side, as shown in the accompanying sketch. These tanks shall be connected to the carbureter so that by means of two cocks or their equivalent one tank may be "cut in" and the other "cut out" simultaneously. Of these two tanks, one is a reserve tank, used for maneuvering when measurement of the fuel is not being made. This tank may be a fixture if so desired. The other is a weighing tank, to be used during the runs for the measurement of fuel. This must be capable of easy detachment so that it can be weighed and replaced without difficulty. It must be large enough to contain fuel sufficient to enable the car to complete its run at maximum speed without refilling.

24—The procedure relative to the tanks is as follows:

Each tank is to be filled with fuel.

After filling, the weight of the weighing tank with fuel is to be accurately determined and recorded. It is suggested that a carefully calibrated spring balance be used. Following this the weighing tank is to be mounted in position.

The engine and car shall be brought to the normal temperature and speed of the run before crossing the starting line on fuel from the reserve tank. Upon crossing the starting line the reserve tank shall be cut out and the weighing tank cut in.

When the course is such as to necessitate interruptions in the run due to turning, the same procedure shall be repeated at each end of the course.

Upon crossing the finish line at the conclusion of each run, the weighing tank shall be cut out. It shall then be removed from its attachment and with its contents carefully weighed. The weight of the fuel consumed having been recorded, the tank may be refilled and weighed again previous to the commencement of the succeeding run.

25—Before the commencement of each run a setting of the throttle shall be determined which shall give the average speed desired for the run. During the run this setting shall remain fixed. The time for each lap is to be checked by the observer and in no case must the time of the slowest lap exceed that of the fastest lap by more than 10 per cent of the latter.

Acceleration Runs

26—The acceleration runs shall only be made on a straight portion of the course.

27—Each acceleration run shall start from a constant speed equal to the minimum speed obtained in the fuel economy runs and shall continue until the maximum speed of the car is reached.

28—There shall be ten such runs made consecutively over the same course, reversing the direction each time. The data from each of these runs shall be recorded. The final result shall be the average of the ten runs.

29—In determining the acceleration an electrical timing apparatus shall be used. This shall provide means for making or breaking an electrical contact at definite and equal distances on the course.

30—From the record of this apparatus shall be obtained data showing in the form of a curve the relation between acceleration in feet per second per second and speed of the car in miles per hour.

It was pointed out in the discussion that no allowance could be made for pressure or vacuum fuel feed. Owing to the difficulty in determining what a stock car is, Herbert Chase, chief engineer of the Automobile Club of America, suggested the stock car clause to be omitted. B. B. Bachman, Autocar Co.; A. L. Riker, Locomobile Co., and W. H. Conant, Gould Storage Battery Co., strongly objected to the council approving referees or courses, since that would be an indorsement of results of tests which would lead to misuse of the society's name in advertising. Eventually the report was accepted as of progress, with clauses 1 and 2 referred back for reconsideration. A test will be made before the winter meeting to try out the method.

Headlamp Glare

In the afternoon headlight glare and truck standards were the chief subjects discussed.

The matter of headlamps and glare was opened by Chairman Clayden, who read the address given on pages 674 and 675 of this issue. Following it, A. L. Riker, chairman of the electrical equipment division, read the report of the work done since June, which follows:

Electrical Equipment Report

1—Most of the more important work of the electrical equipment division has progressed nearly to the stage at which final reports can be made. A revision of the matter on Data Sheets 38a is presented herewith with the final approval of the division; also a recommendation for taillamp glasses. Recommendations relating to details of headlamps are given in tentative form, final action on the details being withheld to await trial under manufacturing conditions. If no unexpected difficulties arise, final action will be taken by the division within the next 1 or 2 months.

Taillamp Glasses — 2 — Investigation has shown that practically all makers of taillamps are using glasses having a nominal diameter of 3 in. with tolerance of minus 1/64 and plus 1/32 in. It is recommended that these dimensions be made standard.

3—In view of the different forms of dust-proof devices, as well as the use of flat and convex lenses, it is considered inadvisable to standardize headlamp glasses.

Size and Location of Headlamp Bulb Filaments—4—The tentative recommendations in regard to size and form of filaments for headlamp bulbs are as follows:

5—The vacuum bulb shall have a filament in the form of a helix of 2.5 mm. outside diameter and 4.2 mm. long, the axis of the helix coinciding with the axis of the bulb, as in the sketch.

6—The gas-filled bulb shall have a V-shaped filament (each leg of the V being formed of a fine helix) lying in a plane passing through the axis of the bulb and at 90 deg. from the plane of the locating pins in the base, with the apex of the V pointing away from the receptacle. The

(*Continued on page* 679)

Bad Truck Measures for N. J.?

Recommendations of Special Committee Would Practically Bar Trucks from State

NEW YORK CITY, Oct. 16—It will be commercially impossible to operate a motor truck in New Jersey if the recommendations of the special committee appointed by William L. Dill, Commissioner of Motor Vehicles of that State, are enacted into law.

Among the most glaring of the absurdities with which the committee seeks to burden the motor truck operator is one that each truck driver must carry waybills for each load, these waybills to show the gross weight and net weight carried. Another is that all commercial vehicles shall carry spare wheels, so as to avoid the possibility of any part of the steel rims coming into contact with the surface of the road should the rubber tires become damaged.

Nor were these two recommendations the only ones the committee, which is formed of engineers of several of the counties of the State, seeks to impose.

It also would limit the width of any truck over 4000 lb. weight to 96 in., outside measurement.

Another suggestion is that the extreme length of motor trucks shall not exceed 23 ft. 6 in.

Another suggested statute would make it prohibitory for a motor truck to be equipped with any tire covering of metal, or with any lugs or hobs or other sharp devices which would be in contact with the surface of the road, except non-skid chains.

Still another is that not more than one trailer shall be allowed to any commercial vehicle and that in every case the trailer shall be equipped with rubber tires.

Nor is this all, for the committee seeks to increase the truck registration fees from the present maximum of $25 to a maximum of $125.

Prest-O-Lite Gets Injunction

INDIANAPOLIS, IND., Oct. 16—Judge A. B. Anderson in Federal Court last week granted a permanent injunction in behalf of the Prest-O-Lite Co., of this city against ,O. K. Stuart, of the Sun Lite Gas Co., Alexandria, Ind., which forbids the latter from refilling Prest-O-Lite tanks.

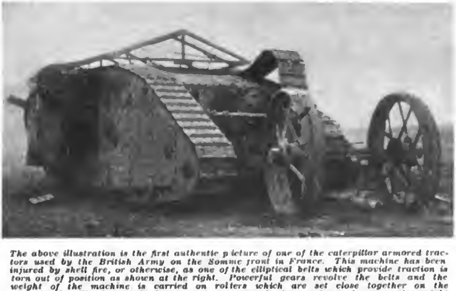
Kent Plant in Belleville

BELLEVILLE, N. J., Oct. 17—The Kent Motors Corp. plans to establish a plant in this city costing more than $500,000 with potential capacity for 50,000 cars a year. The plant will be 125 by 400 ft. Work will soon begin on three structures, a factory, power house and assembly building.

Pullman Leases Sphinx Plant

YORK, PA., Oct. 12—The Pullman Motor Car Co., this city, has leased the entire plant of the Sphinx Motor Car Co., and will use it for making bodies and other sheet metal parts.

First Photograph of a British War Tank



The above illustration is the first authentic picture of one of the caterpillar armored tractors used by the British Army on the Somme front in France. This machine has been injured by shell fire, or otherwise, as one of the elliptical belts which provide traction is torn out of position as shown at the right. Powerful gears revolve the belts and the weight of the machine is carried on rollers which are set close together on the ground side. The large wheels shown in the rear do the steering and support the weight of the tractor when crossing a shell crater or trench, thus greatly increasing its mobile length. Each machine is fitted with three or four machine guns and can fire 2000 bullets a minute, according to reports from the scene of operations.

Photo by Underwood & Underwood.

Argentine Trade-mark Law—II

Definitions of Trade-marks and Copyright Classifications for the Automobile Industry

BUENOS AIRES, ARGENTINA, Sept. 15—There are several general considerations with regard to automobile trade-marks in the Argentina that should be kept in mind by U. S. A. automobile manufacturers in addition to those mentioned in THE AUTOMOBILE last week.

A trade-mark may consist of names of objects of persons in a special form; portraits, emblems, monographs, designs, borders, fancy words, letters, or numbers of special designs or forming combinations; containers or special form, etc.

Not registrable: Coats of arms, flags or other insignia of the Argentine nation. (By a recent ruling the coats of arms or flags of foreign nations may be registered by consent of the respective legation); the form of the product itself; the color of the same; terms or expressions which have become of general use; designations usually employed to indicate the nature or class of the products; immoral designs or expressions.

Procedure: On filing the application the description in duplicate accompanied by labels and an electroplate of the mark (not to exceed 3⅛ in. by 3⅞ in.) must accompany the petition, unless the mark consists of a "fancy word" only, in which case the electroplate may be omitted at option of applicant. The entire payment of Government fees for the term of 10 years is also paid ($50 Argentine) as well as the power of attorney in case the applicant is non-resident. The above mentioned fee together with the expenses of legalization and translation of power of attorney and $1 for each sheet of paper used during the entire prosecution of the case, including communications of the Office and replies to same, constitute the costs of the case, so that the agent or attorney who makes a fixed price is never sure of the exact amount of his profit, which at usual rates is little enough at the best. In case of rejection the first fee is returned at the cost of some more "stamped paper" and trouble on the part of the agent, or another mark may be substituted at a slight additional expense.

Publication: A few days after filing the mark is published during five consecutive days in the *Boletin Oficial* together with the name of applicant and the class of goods to be covered by the registration. After the last day of publication there is a statutory period of 30 days during which any persons deeming

(Continued on page 680)

Princess Cars in Production

Ten Cars a Day Present Output—$50,000 Worth of New Machinery

DETROIT, MICH., Oct. 17—Active production on the new models has started at the factory of the Princess Motor Car Co. The present manufacturing schedule calls for ten cars a day, and the product now being put out is provided in five different color combinations.

The line includes a five-passenger touring, three-passenger chummy roadster, and a raccabout. The cars are equipped with a Golden, Belknap & Swartz engine, with Grant-Lees clutch and gearbox. There is a floating axle of Princess design and 32 by 3½ tires. The bore and stroke is 3¾ by 4¼ and the chassis has a wheelbase of 108 in. Disco lighting and starting is used, this being a two-unit system. For ignition, a Splitdorf-Dixie magneto is fitted. Featuring the equipment is a fuse box on the dash which is unique in a car of this price. Another special point in the fitting of the car is that nothing but genuine leather is used in the upholstery.

The Princess plant has recently been completely overhauled and $50,000 worth of new machinery is just being installed. The new models which sell for $775 are being delivered regularly.

Willard Completes New Building

CLEVELAND, OHIO, Oct. 14—The Willard Storage Battery Co. has just completed the first of its new buildings at the plant located at 274 East 131st Street.

This building will be occupied by the forming rooms which have previously been located at the old plant, corner Marquette and Lakeside. The building contains 90,000 sq. ft. and is of the very latest and most approved type of construction.

Work has been started on the second building, which will be two stories and will contain 75,000 sq. ft. This building will be occupied by the factory office, machine shop and storeroom.

Mickim Heads Liberty Advertising

DETROIT, MICH., Oct. 17—Robert Mickim, formerly advertising manager of the Ford Motor Co. of Canada, has been appointed advertising manager of the Liberty Motor Car Co., to succeed H. L. Buller, whose resignation took effect last week.

Jordan to Double Capacity

CLEVELAND, OHIO, Oct. 16—Plans are now being prepared for the Jordan Motor Car Co. for the erection of a new building, which will double its factory capacity.

The Jordan company started deliveries Aug. 15, and to date have produced and delivered at the average rate of eight daily for the whole period, and the daily production now is ten.

The new building will be of the same size as the original, occupying 30,000 sq. ft. of floor space, and will be erected for occupancy late in the winter or early in the spring.

It is understood the new building will be used for body mounting and final assembling and inspection. At present the Jordan company is using a tent to take care of the overflow.

18,000 Grants for 1917

CLEVELAND, OHIO, Oct. 14—The directors of the Grant Motor Corp. met in Cleveland, yesterday, and declared the regular 1¾ quarterly dividend on preferred stock, payable Nov. 1 to holders of record Oct. 15.

The board passed on and authorized the building of 18,000 cars for the year beginning Feb. 1, and the production is expected to be 20,000 before 1917.

Velie Production Increased 300%

MOLINE, ILL., Oct. 17—The factory production of the Velie Motor Vehicle Co., this city, has increased 300 per cent. Four of the Velie buildings are now occupied by the passenger car department.

The increase in production of the truck department over that of a year ago is 260 per cent.

British Makers Fear U. S. A. Cars

Boycott Suggested—Must Keep Enlarged Car Plants Busy After War

LONDON, ENG., Oct. 7—The recent announcement that the Ford company would establish a plant in England has brought forth proposals to boycott the low-priced American car. It has been suggested that all cars not manufactured in the allied countries be excluded from the British markets after the war.

The war has been the cause for great factory expansion and though the plants at present are busy on munition work and are well equipped with tools and appliances for taking care of a large production, the future use of these immense buildings has been a great source of worry to the country. The British automobile industry is particularly well equipped for rapid production, and so there seems no reason why it should not, in a very short time after the war, produce the desired cheap cars so as to repel the American invasion.

British automobile makers hold that some such agreement should be reached on the ground that as soon as the war is over and freights drop to normal Europe stands a great chance of being flooded with cheap American cars selling from $250 upward.

Up to the present time the British au-

Jitneys Handle Overflow of Hyatt Workers

Jitney buses lined up outside the factories of the Hyatt Roller Bearing Co., Newark, N. J., to take the overflow of workers home. This line-up is a regular occurrence at the plant, morning, noon and night. Fares are 5 cents, and the buses have regular routes designated by signs which they carry. The Hyatt company is one of the units of the United Motors Corp. and employs 5000 persons tomobile manufacturers have paid scant attention to the little car, for the reason that they have had more orders for their high-priced cars than they could execute. Conditions are changing, however, and the European trade is awakening to the possibilities of the low-priced car in that market.

Dividends Declared

Willys-Overland Co.; quarterly of 75 cents a share, payable Nov. 1 to stock of record Oct. 23.

Kelsey Wheel Co.; quarterly 1¾ per cent on preferred, payable Nov. 1 to stock of record Oct. 16.

Pennsylvania Rubber Co.; 1¾ per cent on preferred and 1½ per cent on common, payable Jan. 1 to holders of record Dec. 15.

Fisher Body Corp.; quarterly of 1¾ per cent on preferred payable Nov. 1 to stock of record Oct. 17.

Bower Roller Bearing Co.; quarterly of 15 per cent, making 45 per cent cash dividends so far this year. Also a stock dividend of 100 per cent recommended to be passed on at annual meeting in January.

Globe Rubber Tire Mfg. Co., semi-annual of 3½ per cent on preferred, payable Nov. 1, to stock of record at close of business Oct. 27.

Reo Motor Co., extra of 7½ per cent and quarterly of 2½ per cent, payable Nov. 1 to stock of record Oct. 16.

Nash Motors Co., initial quarterly of $1.75 per share on preferred, payable Nov. 1 to stock of record Oct. 20.

Hood Rubber Co., quarterly of 1¾ per cent on preferred, payable Nov. 1 to stock of record Oct. 27.

Bower Recommends 100% Stock Dividend

DETROIT, MICH., Oct. 14—After declaring a quarterly dividend of 15 per cent the directors of the Bower Roller Bearing Co. recommended that a stock dividend of 100 per cent be approved by the stockholders at their annual meeting in January.

Gasoline Pumps Are Inaccurate

Over 5,000,000 Gal. Lost in West as Result of Short Measuring

CHICAGO, ILL., Oct. 16—Two matters featured the gasoline situation in the Central West this week, one being a rather general drop in prices, and the other, charges of short-measuring pumps. In Chicago, gasoline is selling at 15.6 cents a gallon, which is a drop of 1 cent since the first week in October. The same price prevails at Milwaukee, the Standard Oil being the first to cut the price 1 cent which was met by the independents.

Reports coming from Bloomington and other Illinois cities indicate that the price of 15½ cents a gallon is rather general throughout the State. The city motorists now have to pay 16½ cents per gallon, whereas they were paying 17½ up to Oct. 10.

Approximately half the gasoline troughs that have been inspected in Chicago since June 12 have been condemned, 956 inspections having been made to date. Government inspectors are working with the city forces.

Results of an investigation of gasoline measuring pumps in Illinois made by the United States Bureau of Standards show that in tests conducted in Chicago and typical suburban and rural communities downstate, the Government inspectors found 82 per cent of the Chicago gasoline pumps, and 83 per cent of those outside Chicago, inaccurate. The average shortage was 3.9 cu. in. per gallon in Chicago, and 7 cu. in. per gallon downstate. It is estimated that this shortage means a loss of more than 5,000,000 gal. per year, or $1,000,000 at the present price of gas in Illinois. A tolerance of 0.1 cu. in. per gallon is allowed. Gasoline users in the Twin Cities are getting full measure according to a recent inspection of pumps in Minneapolis and St. Paul.

The Bureau of Standards of the Department of Commerce recently published a report pertaining to the accuracy of liquid measuring pumps in which it states the principal causes of short delivery are caused by leaks in valves or piping; formation of vapor due to excessive suction lift, or the introduction of air under the pistons; failure to correct for the inertia of a long column of moving liquid; the use of long filling hoses with a low connection at the pump making proper drains of holes an impossibility; operation of pump at less than full stroke; and slippage past valves and pistons.

New Polack Truck Tire Organization Formed

NEW YORK CITY, Oct. 14—The Polack Truck Tyre Corp. has been organized to take over the assets and business of the Polack Tyre & Rubber Co., Bridgeport, maker of solid rubber tires for commercial vehicles.

The new company is offering through E. B. Eames & Co., this city, 40,000 shares of stock at $12.50 per share out of a total capitalization of the company of 100,000 shares, no par value.

The refinancing plan provides the funds for the erection of a new plant. It is estimated that when the new plant is completed the company will earn about $3.50 a share. The stock, it is stated, will be listed on the New York Curb and the Cleveland Stock Exchange.

Massnick Mfg. Co. Now

DETROIT, MICH., Oct. 16—The Massnick Mfg. Co. is the new name of the Massnick-Phipps Mfg. Co. There has been no change in the stock ownership or control and the management remains the same.

Crude Oil Higher

NEW YORK CITY, Oct. 18—The materials markets last week were featured by a gain of 10 cents a barrel in Pennsylvania crude oil, which rose to $2.50. The principal purchasing agencies are continuing their efforts to bring to the refineries the large quantities of crude oil now in the hands of the producers, and as a result have raised prices to induce the holders to sell. It is stated that the producers are hoarding the supplies.

Steel prices still hold at $45 per ton on both Bessemer and open-hearth. Beams and channels quote at $2.87 per 100 lb. Automobile makers are actively in the market for soft steel bars for shipment over the first half of 1917. Much difficulty is experienced in having contracts accepted. Several of the Detroit makers are now in the market for about 50,000 tons of bars in the aggregate. All

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.11¼	.11¼	.11¼	.12¾	.12¾	.12¾	+ .01½
Antimony, lb.	.65	.65	.65	.65	.65	.65	...
Beams and Channels, 100 lb.	2.87	2.87	2.87	2.87	2.87	2.87	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	11.65	11.80	11.80	12.15	12.10	12.05	+ .40
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.60	.60	.60	+ .02
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.08	...
Lead, 100 lb.	7.05	7.05	7.05	7.05	7.05	7.05	...
Linseed Oil, gal.	.82	.82	.82	.82	.82	.82	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.73	.72	.72	.72	.72	.72	— .01
Rubber, Ceylon First Latex, lb.	.64	.63½	.63½	.63½	.62½	.62½	— .01½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	44.00	42.25	42.25	41.75	41.75	41.25	—3.75
Tire Scrap, lb.	.06	.06	.06	.06	.06	.06	...

the steel mills are filled up and can take little additional business except for delivery in the far future.

Crude rubber prices have softened after a temporary stiffening, due to the activities of the German submarine. Trading was light. Up-river is selling at 72 cents a pound, spot, while for November-December delivery the quotation was 68½ cents. The wide margin was said to be due to the fact that only one boat carrying Brazilian rubber is scheduled to arrive here this month.

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Hoover Steel Ball Grows Fast

DETROIT, MICH., Oct. 16—The recent meeting of the directors of the Hoover Steel Ball Co. of Ann Arbor has revealed the phenomenal growth of the company. The capital stock of the concern, which makes steel balls for machinery, was increased from $500,000 to $1,800,000.

The concern came to Ann Arbor in 1913, being the old defunct Flanders company ball bearing department. It started with floorspace of 29,000 ft. and thirty-two employees and annual sales of $163,000 the first year. Floorspace is now 112,506 sq. ft., there are more than 700 employees and the sales record up to July 31 is $1,310,001. Dividends to the amount of $264,975 cash, and stock dividends of $150,770 have been made to-date, and according to the company's report every stockholder has received back his original investment in dividends.

The company has on its books now, orders for 400,000,000 ¼-in. basis balls which are as yet unfilled.

Security Prices Advance

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General Motors, Chevrolet and United Motors Rise on Good Market

NEW YORK CITY, Oct. 18—Despite bearish activities, automobile and accessory issues last week held strong, and holders of these issues on margin netted large gains on a number of the stocks. General Motors on the Stock Exchange and United Motors on the Curb featured the week's activities with gains of 40 and 5 points, respectively. Although trading in such an expensive issue as General Motors is necessarily restricted, the behavior of that stock in the last few days seems to indicate that stockholders are inclined to look favorably on the new reorganization plan presented by the directors. On Monday the stock opened at 760 and closed at 779½, and yesterday there was a further advance to 790, the highest price the stock has ever touched; in fact, the highest price any stock listed on the Stock Exchange has ever reached in the regular way of trading.

United Motors has been subjected to much short-selling. Speculators believed that it would decline on account of the submarine scare, but the stock has steadily risen on account of heavy outside buying and as a result those holding the stock on margin were treated to a gain of $5 a share for the week. Rumors state that this stock is slated to go much above 100 before Christmas.

Several of the tire issues were strong and higher. Firestone continued on its skyward movement and reached 1125, a gain of 5 points; Fisk common rose 5 points; Miller Rubber rose 5 points; and the rest of the issues rose fractionally.

Activities on the Detroit Exchange, on the other hand, were mainly subject to short selling. Prices were lower. General Motors dropped 10 points; Maxwell declined 8 points; Studebaker dropped 6½ points; other losses ranged from a fraction to 5 points.

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Kelly Truck Capital $7,000,000

COLUMBUS, OHIO, Oct. 13—The Kelly-Springfield Motor Truck Co., has filed papers with the Secretary of State increasing its stock from $1,740,000 to $7,000,000. The shareholders have ratified the increase. The shares will be divided as follows: Common, $2,000,000, against $900,000, formerly; preferred, $5,000,000, compared with $840,000.

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Republic Rubber Enlarges

YOUNGSTOWN, OHIO, Oct. 14—The Republic Rubber Co., this city, has offered 10,475 shares of its common stock pro rata, at par, to its common stockholders. The proceeds, about $1,000,000, will be used for working capital and extensions.

The members of the executive committee of the board of directors have asked the stockholders to waive their rights to subscribe to an additional 5000 shares of common stock. It is understood that this block of stock will be held for dis-

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	63	65	— ½
J. I. Case T. M. Co. pfd.	82	88	..
Chalmers Motor Co. com.	95	105	—35
Chalmers Motor Co. pfd.	92	96	+3
*Chandler Motor Car Co.	104	105½	..
Chevrolet Motor Co.	195	198	+5
Fisher Body Corp.	40⅛	42½	—1½
Fisk Rubber Co. com.	95	100	+5
Fisk Rubber Co. 1st pfd.	112	115	+2
Fisk Rubber Co. 2d pfd.	100	110	..
Firestone Tire & Rubber Co. com.	1125	1150	+5
Firestone Tire & Rubber Co. pfd.	110	111	..
*General Motors Co. com.	730	780	+40
*General Motors Co. pfd.	122½	123¾	—3½
*B. F. Goodrich Co. com.	73	73⅜	+ ⅜
*B. F. Goodrich Co. pfd.	113¾	114	+ ½
Goodyear Tire & Rubber Co. com.	296	298	..
Goodyear Tire & Rubber Co. pfd.	107¼	108½	+ ¼
Grant Motor Car Corp.	7	10	—1¾
Hupp Motor Car Corp. com.	5⅜	6	..
Hupp Motor Car Corp. pfd.	80	100	..
International Motor Co. com.	4	7	+ ½
International Motor Co. pfd.	18	22	+3
*Kelly-Springfield Tire Co. com.	77	78	—2½
*Kelly-Springfield Tire Co. 1st pfd.	97	100	—1
*Lee Rubber & Tire Corp.	43	44	— ½
*Maxwell Motor Co. com.	89	89½	—1
*Maxwell Motor Co. 1st pfd.	86½	87	+ ⅜
*Maxwell Motor Co. 2d pfd.	55	56	—1½
Miller Rubber Co. com.	240	250	+10
Miller Rubber Co. pfd.	104	106	..
Packard Motor Car Co. com.	170	190	+5
Packard Motor Car Co. pfd.	98	104	+3
Paige-Detroit Motor Car Co.	38	39	+2
Peerless Truck & Motor Corp.	22½	24½	—1
Portage Rubber Co. com.	174	176	+1
Portage Rubber Co. pfd.	173	174	..
Regal Motor Car Co. pfd.	17	22	..
Reo Motor Car Co.	44½	45⅜	..
Saxon Motor Car Corp.	78	79	+ ¼
Springfield Body Corp. com.	90	100	..
Springfield Body Corp. pfd.	120	130	..
Standard Motor Construction Co.	7½	8	..
Stewart-Warner Speed. Corp. com.	115	117	+2
Stewart-Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	131½	132½	..
*Studebaker Corp. pfd.	110½	111½	+1⅜
Stutz Motor	65	66½	..
Swinehart Tire & Rubber Co.	85	90	..
United Motors Corp.	67½	69½	+5
*U. S. Rubber Co. com.	59	59¾	+ ⅞
*U. S. Rubber Co. pfd.	112½	112⅞	—1¼
White Motor Co.	56½	57½	+1½
*Willys-Overland Co. com.	44¾	45	+1
*Willys-Overland Co. pfd.	102½	103	+ ⅜

*At close Oct. 16, 1916. Listed New York Stock Exchange.
Quotations by John Bornham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	41	43½	..
Chalmers Motor Co. com.	95	106	..
Chalmers Motor Co. pfd.	..	95	..
Continental Motor Co. com.	36¾	37½	— ¼
Continental Motor Co. pfd.	9½	10½	..
Ford Motor Co. of Canada	..	305	..
General Motors Co. com.	700	760	—10
General Motors Co. pfd.	121	125¼	—5
Maxwell Motor Co. com.	83½	86½	—8
Maxwell Motor Co. 1st pfd.	84	87	—2
Maxwell Motor Co. 2d pfd.	53	56	—3½
Packard Motor Car Co. com.	..	180	..
Packard Motor Car Co. pfd.	..	102	..
Paige-Detroit Motor Car Co.	37½	38½	..
W. K. Prudden Co.	..	50	..
Reo Motor Car Co.	44¼	45¼	+ ¼
Studebaker Corp. com.	127	130	—6½
Stodebaker Corp. pfd.	107	..	..
C. M. Hall Lamp Co.	28½	30	+ ½

INACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	18	..	..

position by the directors in the future development of the company.

The additional stock issue is equivalent to 40 per cent of the present outstanding common stock which is $2,500,000. The outstanding preferred amounts to $3,450,000.

Selden Truck Sales Gain 258 Per Cent

ROCHESTER, N. Y., Oct. 14—An increase of 258 per cent was made by the Selden Truck Sales Co., this city, in the period of 8 months, extending from Jan. 1 to Aug. 31. September shipments of 1916 increased 121 per cent over the same month in 1915.

Canadian Ford Co. Earns 15.8 Per Cent

DETROIT, MICH., Oct. 13—The net earnings of the Ford Motor Co. of Canada, Ltd., for the fiscal year of 10 months ending July 31, after deduction of $716,136 for special war taxes, were $1,109,322.14. The net earnings are equivalent to 15.8 per cent on the outstanding $7,000,000 of the company's authorized $10,000,000 of capital stock.

The net earnings for the latest year prior to the war tax deductions were $3,202,000 for a full year of 12 months ending in 1915.

Difficulties in obtaining vessels for export business reduced earnings.

Everitt Tractor Tried Out

DETROIT, MICH., Oct. 13—B. Everitt has recently given his Everitt tractor a series of tests through Michigan farms. Hundreds of acres have been turned up, and in one test 11 acres were plowed in 9½ hr.

Resta in Lead for Championship

Chicago Victory Brings His Total in the Ranking of Drivers to 3200

NEW YORK CITY, Oct. 17—Dario Resta now leads the list in the 1916 racing championship with a total of 3200 points, having pulled himself out of second position by his victory at Chicago last Saturday, which netted him 800 points, enough to nose out Aitken, the former leader. The latter is now second in the standing with 2940 points.

The order of the championship standing is:

Resta	3200	LeCain	120
Aitken	2940	Oldfield	80
Rickenbacher	2210	Taft	75
De Palma	1790	Pullen	70
D'Alene	1120	Halbe	60
Milton	690	Stringer	56
Mulford	620	Adams	55
Lewis	600	Cooper	55
Christiaens	540	Gable	45
Henderson	517	Wilcox	40
Vail	450	Chandler	40
Galvin	385	Watson	35
Devigne	320	Sorensen	35
Hughes	275	Johnson	30
Buzane	210	Devore	30
O'Donnell	185	McCarthy	25
Devlin	140	Muller	20
Klein	125		

Cadillac Breaks Record Across Iowa

DES MOINES, Ia., Oct. 14.—H. R. Wells of Des Moines drove a Cadillac eight across Iowa over the River-to-River Road on Oct. 11 in 7 hours and 49 min. The total distance covered was 331.2 miles and the miles per hour elapsed time was 42.37. This new record is 50 min. better than the previous mark made in September by W. J. Barndollar in a Packard twin-six over the same route in 8 hr. and 39 min. The same route was used also by Mulford in his recent runs across Iowa. Wells drove a touring car with top and windshield up and carried three passengers. He left Davenport at 6:37 a. m. and was checked in at Council Bluffs at 2:26 p. m. The last 142 miles of the run was covered at the rate of 44 m. p. h. Wells set a cross-Iowa record of 9 hr. and 14 min. 3 years ago and this stood until the Barndollar record of last month which was over a shorter mileage than that covered by Wells in his old record.

Myle-Mayker Gives 26.6 M.P.G. on Ford in A. A. A. Test

CHICAGO, ILL., Oct. 16—In a test held under the supervision of the American Automobile Assn. a Ford car was driven 26.6 m.p.g. after being equipped with a Myle-Mayker, produced by the Myle-Mayker Co., this city. The car, weighing 2267 lb., with four passengers and the top and windshield up, first made 22.5 m.p.g. without the Myle-Mayker. The addition of the Myle-Mayker, which was attached to the standard carbureter in about 1½ min., increased the mileage to 26.6. Acceleration tests without the device gave an increase from 7.5 m.p.h. to 30 m.p.h. in 24 sec. With the Myle-Mayker the same increase was made in 22 sec.

Allen Adds Two Closed Models

FOSTORIA, OHIO, Oct. 16—The Allen Motor Co. has added two closed models to its line. These are a coupé, at $1,075,

Brown-Lipe-Chapin Co. Sold to United Motors

(*Continued from page 641*)

wealthy Syracuse capitalists connected with the Smith-Premier typewriter company. The connection of these gentlemen with Brown-Lipe-Chapin has been that they have owned approximately one-half of the stock, the remainder being held by C. W. Mott and his General Motors associates.

This latest purchase gives the United Motors Corp. a strong array of seven large progressive manufacturing organizations, each of which is continued as separate manufacturing concerns. The list to date includes: Hyatt, New Departure, Delco, Remy, Perlman, Klaxon and Brown-Lipe-Chapin. Some conception of the magnitude of these different concerns may be had from detailed figures on each.

The Dayton Engineering Laboratories occupies seven buildings and has 11 acres of floor space. Last year it produced 142,500 Delco installations and aims at 250,000 for next year. On July 15, 500,000 Delco installations were in use.

The Hyatt Roller Bearing Co. occupies twenty-one buildings with a total of 900,000 sq. ft. floor area. It employs 5000 persons and has a daily capacity of 40,000 roller bearings. Over 7,500,000 Hyatt bearings were furnished to the automobile industry in 1916 and it is estimated that 10,000,000 will be furnished for 1917.

The New Departure Mfg. Co. is manufacturing 21,000 bearings per day and by July 1 hopes to have capacity for 30,000 to 35,000 per day. The company is at present operating two factories, the major one at Bristol, Conn., and one for small bearings at Hartford, Conn. Its factory capacity will be doubled by July 1.

The Remy Electric Co. has a plant of twent-nine buildings with a floor area of 169,000 sq. ft. or equivalent to 4¾ acres. The present output is 950 ignition systems per day to which must be added 400 generators and 350 starting motors. This year's production will total 410,000 ignition systems and 125,000 starting and lighting systems.

The Perlman Rim Corp., a recent incorporation, followed the court decision on the Perlman rim patent rendered some months ago. The company secured the plant of the Jackson Rim Co., the capacity of which is being doubled, to give a total floor area of 129,400 ft. Some months ago the factory capacity was 2000 sets of rims or 10,000 individual rims per day. This capacity is being increased by new buildings which are now in course of construction.

The Brown-Lipe-Chapin Co., making differentials entirely, employs upward of 2000 workmen, and is the largest differential making concern in the world.

Lovell-McConnell Mfg. Co., manufacturer of Klaxon horns, was purchased in September, and plans made to double the production schedule.

and a convertible five-passenger sedan at $1,095. The sedan is a convertible type in which the roof is permanent and the windows and door fillers can be removed and put out of sight in a compartment back of the rear seat. Both cars are mounted on the standard Allen chassis.

Five Moon Closed Models

ST. LOUIS, MO., Oct. 12—The Moon Motor Car Co., this city, will build five closed body models which will be ready for delivery in November, as follows:

Model 6-43—touring with demountable top, $1,450.

Model 6-43—cabriolet, seats three people abreast and one on drop seat, $1,850.

Model 6-66—cabriolet, seats three people abreast and one on drop seat, $2,150.

Model 6-66—coupe, seats three people abreast and one on drop seat, $2,150.

Model 6-66—sedan, with sloping windshield, single door at each side, and seven-passenger capacity, of Springfield metal body type, $2,250.

Firestone Holds Sales Convention

AKRON, OHIO, Oct. 15—The Firestone Tire & Rubber Co., this city, is holding its annual sales convention this week, starting Oct. 17 and continuing for 3 days. About 500 salesmen and agents of the company will be in attendance.

Packard Opens Used Truck Department

NEW YORK CITY, Oct. 18—The Packard Motor Car Co. of New York, has opened a used motor truck department at 239-241 West Fifty-sixth Street.

New G. E. Rectifier at Show

Small A.C. Device at Electrical Exposition Uses Argon —Other Exhibits

NEW YORK CITY, Oct. 14.—Several new things of interest to automobilists are exhibited at the Electrical Show at Grand Central Palace. One is a new small-capacity alternating current rectifier shown by the General Electric Co. An entirely new principle is used, the gas in the bulb being argon instead of mercury vapor. It has several advantages over the mercury arc rectifier. It is inherently self-starting; 25 per cent cheaper to build and operate; slightly more efficient; more compact; requires less auxiliary apparatus, and most important of all, it can be made in very small sizes, for charging even a single storage battery. At present it is made in two capacities, 2 and 6 amps. The smaller delivers 1 amp. at 15 volts or 2 amps. at 7.5 volts. The price is $14. The larger is 75 volts and will charge up to thirty cells or ten three-cell batteries. It is equipped with an ammeter and sells for about $100.

Detroit Electric Lowers Price

The price of the Detroit electric has been reduced to $1,775, and a four-passenger body fitted, seating three on the rear seat. In all essential details the machine is the same as its predecessor. It has a forty-two-cell battery, wheelbase is 100 in., tires are 34 by 4½. Standard color is cobalt blue with wire wheels in white, cream, red or blue, as desired by the purchaser.

New 6-Ton G. V. Truck

A 6-ton heavy-duty truck is a new model shown by the General Vehicle Co., L. I. City, N. Y. It has a particularly convenient demountable battery cradle which is so designed that it may be removed either by dropping into place or sliding out to one side. Its speed is 6 m. p. h. and it will operate about 30 miles on a charge, having a forty-four-cell G. V. X. battery. Price is about $5,300 with body. An interesting feature of the body shown, which was for delivering coal, was the use of a Wood hydraulic hoist, driven by an electric motor, permitting the driver to raise the body and discharge its load without leaving the seat.

Hupp Tour Reaches Far West

DETROIT, MICH., Oct. 16—The United America Hupmobile is nearing Seattle after traveling over snow-covered mountains on the trail between Billings, Mont. and encountering several heavy storms. After reaching Seattle the tourists will turn southward and travel as far as Los Angeles.

N. Y. S. A. E. To Discuss Aluminum

(*Continued from page* 643)

universal employment of aluminum.

Concerning aviation motors, the employment of aluminum is carried to the limit. A word or two is devoted to the comparison of the aluminum with the pressed steel construction being tried out on a few experimental motors. Mention is made of the trend toward having the crankshaft lie well within the case, that is, with the crankshaft center line well above the plane of the bottom of the case. The advantages of the cast aluminum band over the steel stamping are mentioned.

The next matter considered is the use of aluminum in the rear axle. Prophecy is made that a great deal more attention is going to be devoted to this question of the reduction of unsprung weight within the next 2 or 3 years than ever before.

The balance, and by far the greater part of the paper is devoted to the employment of aluminum for cylinder construction. The matter is considered historically at the outset. It is pointed out that apparently Europe has stolen the march on this country in the actual production in quantity of aluminum motors, the Hispano-Suiza motor being cited.

A paragraph or so is devoted to answering various questions that have in the past been asked regarding the differences in behavior between an aluminum and a cast-iron motor. The discussion of types of motor is then taken up. Practically every conceivable type of motor has been made, poppet valve, rotary valve and sleeve.

Pistons come in for some attention. That the aluminum piston is the ultimate is very strongly emphasized. Troubles which developed with them are characterized as growing pains. The tendency to carry weight saving to the limit in the aluminum alloy piston is deplored and a saving of 100 per cent should be well worth while. The advisability of the employment of a long piston is receiving attention. The rule is laid down that the length should be equal to 1 1/3 the piston diameter proportions which were advocated in a paper given by the author last November before the society. The motor should be built around the piston and the employment of aluminum pistons should not be an afterthought.

Some little space is devoted to the employment of cast aluminum panels in motor car body construction. The advantages that this type of construction possess are touched upon.

The minor aluminum castings used about a motor car are given some consideration, more particularly the aluminum brake shoe is discussed. A paragraph or so is devoted to the comparative machining of aluminum and cast iron together with some allusion to relative costs. The paper is concluded with a few do's and don'ts that the engineer should bear in mind when designing an aluminum structure. Great stress is laid on the wisdom, in fact, necessity that the engineer should at all times be in very close touch with the foundry when designing structures of this sort.

In the concluding paragraph the fact that the output of aluminum is from 283 lb. in 1886 to 136,400,000 lb. in 1914 is mentioned and an analogy is drawn between that and the development of iron. The paper is accompanied by eighty lantern slides emphasizing some of the points brought out in the paper as well as showing some of the typical castings being produced to-day.

The Automobile

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Taxicab Design

SOME years ago there was a prevalent idea that the manufacture of taxicabs was going to be a profitable undertaking, but experience soon showed that this was not the case in a general way. At present there is an immense demand for good cabs, and practically no supply worth talking about.

The taxicab stands half way between the private car and the truck. It must be capable of being handled roughly, yet it has not any great loads to carry. It must have an engine that will be economical of fuel and the chassis and body must be light enough to permit a good tire mileage without being so light that they will give way under the bumps and bangs of taxi chauffering.

More than one taxicab company has tried many sorts of standard touring chassis, and found weaknesses in them all, with the result that it is not uncommon to find these concerns now building their own cabs, using some stock parts and some special ones.

In Europe, much the same state of affairs prevails. The most successful taxicab company in the world is in London. Originally it equipped with French and British chassis costing about $2,000 each, and built special bodies for them. Then, as weakness developed, the repair department was enlarged into a factory, and new parts made to new design, the resulting vehicle being a compromise between the British and French originals with new engineering added.

A taxicab cannot be built cheaply if it is to remain in use for year after year. The service calls for the best workmanship and the best materials, but there should be room in the American industry for a taxicab specialist manufacturer who is not afraid to ask $2,500 for his cab, or even more.

More Standards

THE session of the S. A. E. standards committee, held at the Bureau of Standards, in Washington, on Oct. 18, is not, in many ways, the most important yet, because, for one thing, the number of new proposals to be passed upon is not great. Still, the place of meeting will mark the occasion in the annals of the society.

Engineering standardization began as a thing altogether separate and apart from National standardization. There is a fundamental difference between the standard of money and the S. A. E. carbureter flange standard, for example. However, some engineering standards are national, like the U. S. screw thread, and more will be in the future.

Standards which are law, and hold for all time, are one thing; standards which are custom by agreement, and may have to be changed from time to time, are different; but there is no sharp dividing line. The enormous amount of work done in the past 10 years by engineering societies is obtaining recognition by the governments of the world; governments and the engineering industry are helping each other more than ever before.

Of the total of work done by societies, that belonging exclusively to the S. A. E. stands very high, and lately the S. A. E. and the Bureau have had to consider common subjects simultaneously, and it is probable that the relationship will be much closer in the near future.

The Spotlight

THE use of a spotlight has for many years been forbidden absolutely by the law of Great Britain, because of the power for annoying other road users that it gave a driver. There are signs that similar prohibition may be adopted by several of the States in the Union for the same reason.

The situation is regrettable. The spotlight is really very useful. For reading a sign, for examining a turn in the road, or for driving on a very bad and dangerous highway, where a strong light on the edge of the road is necessary, the spotlight is ideal. If it were only used in this way, in the way its originators intended it to be used, we should hear no complaints; but as things are, the avoidance of a difficult situation appears almost impossible.

The abuse of the spotlight is complicating the glare problem to quite a perceptible extent; it is making the work of those who are really solving the glare matter harder than it needs be. What a pity it is that the abuse of a good thing by a minority of fools should place its existence in jeopardy!

Resta Wins 250-Mile Grand American

Averages 103.99 M.P.H.—Aitken 6.93 Sec. Behind

Aitken, DePalma, Resta and Hughes in a brush early in the race

Prize Winners in the Grand American Race on the Chicago Speedway

Car	Driver	M.P.H.	Prize
Peugeot	Resta	103.99	$6,000
Peugeot	Aitken	103.65	3,000
Maxwell	Rick'bacher	102.08	1,500
Premier	Lewis	98.37	1,000
Maxwell	Henderson	98.34	900
Premier	Galvin	97.81	800
D'senberg	Devore	90.58	600
Ogren	Burt	86.66	500
Erbes	Gable	81.13	400
Hudson	Vail	80.81	300

CHICAGO MOTOR SPEEDWAY, Oct. 14—By the narrow margin of 6.93 sec. Dario Resta continued his unprecedented record of winning every big event on the Chicago Speedway to date. In to-day's 250-mile Grand American race he finished victor with this slender lead over John Aitken, thereby getting back first place in the ranking for the speedway championship of the season. Winning to-day's race, the closest ever witnessed on this speedway, gives Resta 3200 points, while Aitken, who was in the lead up to this afternoon, is now second with 2940. Resta broke his own record of 97.70 m.p.h. for 250 miles on this track.

The race resulted in a three-cornered battle for supremacy between Resta, Aitken and Rickenbacher, who finished third. Resta made but one stop at the pits, changing a right rear tire and taking on gasoline at the 190th mile in 28 sec. This was neither as thrilling nor as costly as Aitken's only pit visit, which occurred shortly after. With a lead of only half a lap over Resta, Aitken blew a right rear and, fearing delay, headed for the pits at terrific speed. Opposite the judges' stand his car started to skid and rocked from side to side till it slid sideways up the track a distance of 100 ft. past the pit, turning completely around. Aitken threw in low gear and shot up to his pit from the wrong direction. Despite the excitement his pit crew changed the tire with the car facing the wrong way and sent him away in 30 sec. But Resta had taken advantage of his opportunity and was well in the lead, a lead which Aitken could not overcome for long though he forged to the front for a brief interval later in the race, the cars running wheel-to-wheel for the last 50 miles.

Rickenbacher's Maxwell was third, 1 min., 29.15 sec. behind Aitken, although his car was not running very well at the start of the race. Lewis, in a Premier, was fourth, with Henderson's Maxwell, Galvin's Premier, Devore's Duesenberg, Burt's Ogren, Gable's Erbes and Vail's Hudson following him across the tape in the order named. Rawlings in the West Duluth was flagged, covering almost the entire distance on three cylinders. Buzane was also flagged.

All track records were smashed up to the end of the first 40 miles by DePalma, who averaged 105 m.p.h.

The race was between the four favorites, Aitken, Resta, DePalma and Rickenbacher, and DePalma led for 120 miles

The Big Four of the race, Rickenbacher, Resta, DePalma and Aitken

Photo by International Film Service

As the race drew near its close, Resta led with Aitken second and Vail third

in one of the most closely fought contests ever seen on an American speedway until he lost first place to Aitken on account of a tire change and then dropped back to third through two stops caused by a broken valve which was the ultimate cause of his withdrawal.

One Serious Accident

One accident marked the day's event and one which may cause the death of Ralph Hetlich, mechanic for Wilfred D'Alene, driving the Crawford. D'Alene came into the pits at the end of his 15th mile for gasoline and the excited pit man spilled gallons of gasoline onto the track under the car and finally some of it, when the funnel was knocked off, was ignited by the exhaust. The car and the gasoline below it burst into flames which rose to 10 ft. in the air. Hetlich's clothing was splattered with burning gasoline and, temporarily crazed by the pain, he ran up the track toward the judges' stand. Here he was headed off by some of the officials who forced him into the dirt under the judges' stand and wrapped coats about him until the burning clothing could be torn off. He was rushed to the hospital and hope for his recovery is held out, although he is very seriously burned.

Billy Chandler, captain of the Crawford team, also was burned about the hands and throat and the back of the head. It was necessary to force him into the ambulance as, in spite of his injuries, he insisted on endeavoring to help Hetlich.

The fire about the Crawford car was put out in 3 min. by the rapid and efficient work of the J-M fire extinguisher crew which, in spite of the fact that it had to run the entire length of the pits to reach the burning car, subdued the flames before great damage had been done to it.

While the car was still hot and smoking from its inundation in flame, D'Alene again took the wheel with a substitute mechanic and resumed the race. He circled the track once but was forced to come in with the brake bands still burning to change one of the rear wheels whose tire had been damaged by fire; also, to make another attempt to fill the gasoline tank. D'Alene was able to make only four laps more before the scorched car was pushed down the track with a broken driveshaft.

DePalma Takes Lead

The actual start after the preliminary lap was a very pretty one, the line being well kept for the getaway. Aitken led at the end of the second lap but DePalma took the lead at the third lap, having passed Hughes, Resta, Henderson, Wilcox and Aitken in a 2-mile spurt that brought the grandstand spectators to their feet. The order at this time was DePalma, Resta, Aitken and Hughes, with a gap beginning to open up between these four leaders and the rest of the field, all of whom were leaving Gable and Buzane some distance in the rear. At the end of the first 10 miles Gable, whose car was missing badly, was lapped in front of the grandstand. Wilcox and Henderson had crawled up until they were respectively second and third to DePalma, with Aitken, Hugher, Resta and Rickenbacher following in order.

D'Alene again hegan to show among the leaders and at the end of 14 miles was well up to the front. The speed was too fast for him and he did not maintain his position long. Before 20 miles were gone the speed began to tell on some of the cars and they began to come into the pits, Burt's Ogren being docked temporarily first, and followed shortly by Buzane in the Duesenberg and Vail's Hudson.

The pace was a terrific one, DePalma's time for first 20 miles being 11 min. 34 sec., with Resta, Hughes, Aitken, and Rickenbacher all close at his heels. Resta's time was only 2 seconds slower than DePalma's, while Aitken was running half a length behind. Rickenbacher, D'Alene, Hughes and Burt were all very close up.

During the next 10 miles Aitken and Rickenbacher passed Hughes and the order then was DePalma, Resta, Aitken and Rickenbacher. DePalma was being sorely pushed, the three Peugeots running so close together that there was not a car length between DePalma and Aitken. Rickenbacher was 100 yd. behind. All were traveling at better than 103 miles per hour. Hughes went out with a broken valve spring in the 32nd mile. It was this that caused him to lose his position during the few miles previous. Hughes asked of the car more than it would stand, and while he made a wonderful showing for the first 25 miles the mechanism would not stand the speed he called from it.

A Four-Cornered Race

For the next 70 miles the four-cornered race between the leaders continued, with the speed slowly increasing, and lapping car after car as the three blue Peugeots and the white Maxwell fought for the lead. But DePalma was never headed in the first century. At 40 miles the time was 23:3.65, a speed of 105 miles per hour. At 50 miles it was 29:50 sec., approximately the same speed.

After the accident to D'Alene's car the speed dropped somewhat for a time but again picked up. At 70 and 80 miles the speed had dropped to 102 miles per hour. Rickenbacher was the first of the quartette to show the effect of the terrific speed, having to come into the pits at about 76 miles for a right rear tire. His pit work was very fast and his time lost slight, not enough to cause him to lose his fourth position. At 80 miles the order of the first ten was as follows: DePalma, Resta, Aitken, Rickenbacher, Wilcox, Devore, Milton, Henderson, Klein and Lewis. DePalma's time for this distance was 45:25, a speed of little better than 102 m. p. h. At 90 miles the order was practically the same throughout, and the speed increased slightly to 102.5 miles per hour. DePalma was still leading at the 100-mile point and his time was 56:58.41, a speed of 105.2 m. p. h. DePalma came in shortly after this, making his first stop and changing a right rear tire. This caused him to drop back into third place, as Resta and Aitken both passed him.

Rickenbacher was improving his opportunity to make up time lost by his stop and still further increased his speed, when he saw DePalma at the pit, making laps at 106 m. p. h. as he forced his car to its utmost.

Resta Sets the Pace

With DePalma temporarily out of the lead, Resta set the pace with Aitken close at his heels, so that at the 120-mile mark Resta was leading, Aitken second and DePalma third, with Rickenbacher a bad fourth. The time at this point was 1:08.22, a speed of 105 m. p. h.

The terrific pace brought Resta in to the pits on the next lap for supplies, taking on gas and changing a right rear tire. The pit work was very fast, Resta being held only 28 sec.

Aitken had not stopped as yet and the two halts by the leaders put him in the front. This he held for the next 70 miles. Resta's stop let DePalma overtake him so that the Italian was pushing Aitken for first with Resta and Rickenbacher following. From the 140-mile point until after approximately 190 miles had been covered he came in with his engine missing badly, and after a lap or two withdrew with a broken valve.

Aitken's Narrow Escape

Almost at the same time Aitken very nearly ended his chances for finishing the race when, in coming in with a flat tire for his first stop at the pits, he skidded badly, turning completely around, but by masterly handling kept the car on its four wheels and pulled up at the pits, facing in directly the wrong direction. He was away in 30 sec., but meanwhile Resta had passed him, taking the lead. The old National driver gave the car all it would take when he took up the chase of the Italian and turned several laps in 1:05, a speed of better than 109 m. p. h. At 200 miles Resta was leading, Aitken second, Rickenbacher third, and Wilcox fourth. Resta made the distance in 2:07.01, with Aitken only 2 sec. behind. Rickenbacher was a minute behind the leader and Wilcox was over 2 min. behind having been lapped by Resta and Aitken. Their speed at this point was close to 105 m. p. h.

Resta and Aitken ran neck-and-neck for the 50 miles remaining but Resta was always a nose ahead of the Indianapolis driver, except for one short space, when Aitken succeeded in crowding ahead temporarily. Resta undeniably could have made more speed at this time had it been necessary for him to call upon his car for it.

Slipping Clutches Give Trouble

THE race developed a new ailment. Slipping clutches have seldom held such an important part in speedway races. Ostewig, in the car bearing his name, was in the pits four times, consuming in the neighborhood of 20 min., dosing his clutch with dirt, sand, and finally inserting hack-saw blades to lock it in place. Milton went out entirely with a shredded-clutch facing and it was the claim that Johnny Aitken's speed was reduced throughout the contest by a clutch that persisted in increasing the ratio between the engine and the rear wheels.

There were thirty-nine stops in all, and only eleven of these were for tires. The other twenty-eight went to patch up mechanical difficulties.

As a matter of habit, Resta's one pit stop was made in record time for the meet. He changed a right rear and took on gasoline in 28 sec. This however was a plain slide-in-and-roll-out-again stop, and not as costly or exciting as Aitken's only pit visit, already described, the Hoosier pilot nearly coming to grief as he tried to shoot into his pit at high speed for a new tire. This stop cost him first place.

The Crawford pit, with one of its cars bearing No. 13, suffered about as disheartening a climax as ever occurred in a Speedway race. After D'Alene took his fire-blackened car back into the race with a new mechanic substituted for the one who was nearly cremated and drove a few more laps a connecting-rod let loose and he was out for good.

On the same lap, Klein's Crawford split a crankshaft and the havoc it wrought in the motor is probably beyond repair. The whole crankcase assembly was literally torn to fragments.

The fire in Devore's Duesenberg can also be attributed to carelessness. He stopped for a tire and the motor did too. The mechanic tried to crank the motor again, and as it would not start he opened the hood and attempted to tickle the carbureter. Instead, he knocked off the cap of the float chamber, the float shot out and the explosive fluid poured itself generously over the car and track. When the motor was cranked, the gasoline-loaded cylinders backfired through the carbureter and started the fireworks. Fortunately it all took place directly in front of the J-M extinguisher pit and these overworked fire-fighters made quick work of it.

Ralph DePalma went out with a broken valve. This Peugeot has been a particular offender in valve trouble, Mulford having run up against the same thing when he drove the car. It is getting to be a conventional statement that Ralph goes out with some part of his motor broken and many race fans have ventured to ask "Where is the DePalma of a year ago?" The veteran driver once carried the reputation of humoring his car in the early part of a race and leaving his spurt for the last. His tactics throughout the 1916 season have been just the reverse, and there does not seem to be a car built that will stand his Burman-like driving.

Other Mechanical Troubles

Again Buzane's Duesenberg sprung a leak in the water pump. This car has this particular trouble as regularly as the starting flag is waved. In to-day's race it was even worse than ever and the water which spurted from the leaky pump packing found its way into the carbureter and caused four pit stops.

Wilcox, another of the Peugeotic contenders, experienced a typical DePalma last hour demise when he rolled into the pits with one lap to go with a broken rod. He was then running in fourth place which made the faulty connecting-rod an expensive investment.

Ira Vail, who drove his battery-ignited, starter-equipped

(Continued on page 673)

Hetlich, D'Alene's mechanic, in flames on the track

Value of Rating Formula Limited

Can Never Involve Any but Qualities Capable of Mathematical Measurement—May Be Useful to Engineers and a Few Car Buyers—Detroit S. A. E. Discusses Fishleigh's* Paper

By J. Edward Schipper

DETROIT, MICH., Oct. 14—The Detroit section of the S. A. E. is agreed that it is impossible to measure all that is meant by the term "Car Performance" in a single formula. This is perhaps not a new idea, but it was certainly crystalized in the discussion following the reading of Professor Walter T. Fishleigh's paper on Automobile Performance and Methods of Comparison at the monthly meeting of the section last night.

Everyone present agreed that it is possible to get a formula that will act as a very satisfactory basis of comparison. The mathematical factors of comparison—speed range, accelerative ability and fuel economy—are basic and can be so treated, but all other things, such as comfort, either mental or physical, ease of control, etc., cannot be embraced by a mathematical expression.

Eliminating the important comfort factor of course removes a large part of the value of a rating factor as far as the average individual that buys a car is concerned, but it in no wise affects a great many points of value which such a formula may have for the engineer or even a car-educated buyer who carries his investigations further than what he would secure from a demonstration. The mathematical factors which remained unscathed by the discussion and which would be above criticism in the rating or performance comparison were those of speed range, accelerative ability and fuel economy.

Whether or not these should be all combined into one figure was a matter considerably open to debate, as it was pointed out that by combining them the relative value of each term was forgotten and therefore they should be allowed to stand in their original form so that a man who was buying a car by this rating method would be able to give greatest weight to either speed range, acceleration or economy. The three factors were called in Professor Fishleigh's paper, *S*, *A* and *E* respectively, being also the initials of the Society.

Professor Fishleigh is a member of the standards committee of the S. A. E., and since one of the divisions of the committee to which he is attached has in hand the matter of determining a standard S. A. E. rating formula, the paper and its discussion take on considerable significance. The question seems to have two sides: first, what is the rating formula for; and second, the determination of the formula.

Last night's meeting seemed to settle the first point very satisfactorily, and summed up in a nutshell it may be stated that the rating formula is for the purpose of comparing the combined factors of performance which are capable of mathematical measurement.

The second part of the question was not so clearly solved, as there was no general agreement on all the factors that should be involved in the final result. The latter difficulty, though, is certainly more easily overcome than the first seemed to be, and a number of formulæ that were satisfactory to 500 members in attendance were offered, particularly by C. T. Myers of the Timken Co., C. C. Hinkley, chief engineer of the Chalmers company, and K. W. Zimmerschied, engineer of the General Motors Co.

Automobile Performance and Methods of Comparison

By Walter T. Fishleigh*

IN general, factors which make for good car performance have come to be more or less agreed upon. In general, the tests which show the degree of car performance or car ability are pretty well recognized, and there is little doubt that if a new model were to be handed over to any committee of three selected from this meeting to-night with instructions to try it out for general performance, approximately the following tests or their equivalent would be made.

1. The car would be driven upon good pavement to determine its range of operating speed, that is the lowest and highest speed at which and between which the engine and car operate steadily and successfully.

2. The acceleration would be tried out, probably starting at the lowest steady operating speed and determining the time necessary to accelerate to its maximum speed, or perhaps the test would be run between two arbitrarily set limits, as from 5 to 55 m.p.h.

3. The car would be tried out on steep grades or hills. This test would involve both high gear work at different speeds, and operation in the gears.

4. Tests would be made upon the road or upon a speedway to determine fuel economy; that is, miles per gallon of gasoline. Economy runs have often been made and advertised as under "average touring conditions," but upon consideration it will be manifest that economy runs, to be scientific, definite and comparable, should be run at a number of definite speeds, as for example, 10, 15, 20, 25, 30, 40, 50 m.p.h. The results will give an economy curve, which tells the complete story of economy at various speeds. An average fuel economy may be found from this curve, but the detail curve itself is not only desirable but necessary.

5. The car would be run over good, bad and indifferent roads, at various speeds, and going through various maneuvers, for the determination of riding comfort. This factor is the resultant of many items in design, such as weight, wheel base, spring suspension, engine characteristics, body and seat design, etc. If carried to the theoretical limit, it is an exponential function also of the way an engine pumps

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*Professor Automobile Engineering, University of Michigan oil and soots the spark plugs, the kind of gear shift employed, the number of punctures per tire per mile, and the percentage rise in small-town hotel prices when the driver pulls up with a particular make of car and applies for accommodations. These latter, though important, may be neglected in the present discussion.

Summing up the above, we may assume that for completely trying out car performance, tests would be run for the determination of (1) range of operating speed, (2) acceleration, (3) hill climbing ability, (4) fuel economy in miles per gallon, (5) riding comfort. It is proposed that acceleration tests be agreed upon as the standard factor in car performance for indicating excess draw-bar pull. Complete performance then becomes the resultant of the following four factors:

1. Speed range
2. Acceleration
3. Economy of fuel
4. Riding comfort

The application of each of these factors needs hardly to be argued; whether there should be more or fewer of them is open to argument.

Expressing our discussion mathematically, we may write: Automobile performance varies directly as speed range, acceleration, economy of fuel and riding comfort.

Automobile performance $\propto S.A.E.C.$

Where S = speed range in high gear, in miles per hour
A = average acceleration of car in feet per second per second over the complete range of its operating speeds.
E = average fuel economy, over the complete range of its operating speeds, in miles per gallon.
C = riding comfort factor, which must be determined by each individual judge.

It is manifest that complete car performance or car ability, on account of the item C, cannot well be determined once for all by rigid tests, nor estimated in any simple and practical way. The one item C must be left to personal judgment, if not to personal eccentricity. In considering car performance, however, the other items ($S.$ $A.$ $E.$) are each susceptible of scientific determination and measurement, and their combination when obtained, while not giving the complete expression and answer for car performance, still affords a valuable comparison for cars and constitutes what might well be called the Automobile Performance Factor.

Automobile Performance Factor $= S.A.E.$

When considered from the standpoint of this three-fold "Automobile Performance Factor," different cars can be definitely tested, a definite value for each item in the factor obtained, and relative performance quantitatively rated as regards speed range, acceleration and economy of fuel. For the engineer, the manufacturer and the buying public this factor affords a ready and reliable means of comparison of car performance, and an investigation of the three items, which go to make up the complete factor, leads at once to comparative values in the details of performance. Illustrating the application of this automobile performance factor, suppose we have two cars; the first with speed range 10 to 50 m.p.h., acceleration from 10 to 50 m.p.h. in 30 sec., average miles per gallon 20; the second with speed range 5 to 65 m.p.h., accelerating from 5 to 65 m.p.h. in 20 sec., average miles per gallon 10.

Automobile Performance Factor $= S.A.E.$
For first car $= 40 \times 20 \times 2$ $(= 1600)$
For second car $= 60 \times 10 \times 4.4$ $(= 2640)$

The value of this factor, or more properly the value of the three items in the factor, coupled with a consideration of item C (riding comfort), leads to accurate estimate of complete car performance or car ability and should form a sound basis upon which to judge the car as an operating unit. Indeed, we may individually go even further, assign a relative percentage value to the comfort factor C, multiply our car performance factor by it, and obtain at once a figure for each car which represents complete car performance or car ability. Some question may rightly be raised as to the relative weight which should be given each of the items S, A and E in the factor, but after extended consideration, it would seem that from the standpoint of importance to the operator, no better than equal weights can be assigned. In this factor, the item "car weight" does not appear separately, but indirectly exerts its influence upon S, A and E. In each case the penalty for increased weight appears in a reduction of the value of acceleration, mileage per gallon of fuel and speed range, the effect upon the final automobile performance factor being marked. It must be clearly emphasized that the items in the performance factor have reference solely to performance of the car as it stands, as an operating unit. The relative advantages of the seven seats of the touring car as compared with three in the roadster, the riding qualities of the heavy car as compared with the light car, the operation of the twin-six engine, as compared to the four or six or eight of equal horsepower, the advantges of the limousine body as compared to the touring car—all these are matters to be settled in a preliminary consideration or to be included with proper weight in the riding comfort, item C. The factor is of particular value in comparing the relative performance of two cars of generally similar characteristics. Nor is it desirable to compare, from the standpoint of performance, widely different structures such as the pleasure car and the truck, vehicles designed for entirely different service, in which the various items which go to make up car performance have entirely different relative values. Indeed, the performance factor for the commercial truck may be quite different and a subject for separate consideration.

A simple and thoroughly accurate acceleration test has been proposed as follows: The car is brought to its lowest successful operating speed and driven at that speed to the starting line of a measured course, where it is accelerated as rapidly as possible to its maximum speed over this course. Measured intervals are laid off along the course, and at each interval a contact point is located which is operated by a small gate carried under the front axle. At the starting line is located a recording drum, revolved by clock mechanism or by electric motor driven by batteries. Writing its record upon this drum is a small marker, which is electrically operated by a calibrated clock and which registers time elapsed in seconds or half seconds. Another marker is electrically operated by each of the various contact points along the course. Thus is obtained an accurate record of the time for traversing each of the measured intervals along the course. From this data, an accurate determination of accelerations at the different speeds can be had, either by means of curve plotting or by calculation. The final acceleration curve will show accelerations in feet per second per second of the car at each speed of its range.

Fig. 1 shows an acceleration curve from a six-cylinder car, total weight 5280 lb., gear ratio 3 10/13 to 1, size of engine 4½ by 5½ in., wheel diameter 37 in. Fig. 2 shows an acceleration curve from an eight-cylinder car, estimated gross weight 4150 lb., gear ratio 5 1/14 to 1, size of engine 3⅛ by 5⅛ in., wheel diameter 36 in.

Typical curves for fuel economy runs at various speeds are shown in Figs. 3 and 4. The curve in Fig. 3 was obtained from tests upon an eight-cylinder car, 3⅛ by 5⅛-in. bore and stroke, gear ratio 4.5 to 1, tires 36 by 4½ in., estimated gross weight 4150 lb. The curve shown in Fig. 4 was obtained from a four-cylinder car, 3⅝ by 4½-in. bore and stroke, gear ratio 3.58 to 1, tires 30 by 3½ in, estimated gross weight 3000 lb.

Other Ability Formulæ

Many formulæ for automobile performance or car ability have been developed. They differ widely in method of ap-

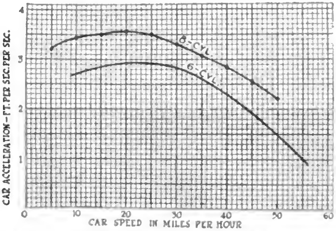


Fig. 1—Acceleration curve for six-cylinder car. Fig. 2—Acceleration curve for eight-cylinder car

proaching the question of performance; they differ in the fundamental factors included; in the majority of cases they are efficiency formulæ strictly, developed for estimating, from engine size, gear ratio, weight, wheel size, etc., what the probable performance or probable performance factors of a car will be; in no cases are they as comprehensive as, in the opinion of the author, they should be to cover the ground of performance; in no case are they based entirely upon accurate, scientific tests which determine at once beyond doubt the true values for the factors which make up performance and, therefore, the true value for performance itself. A consideration of the most important of these formulæ will be of value.

(Symbols used in formulæ):

d = diameter of cylinders in inches
s = stroke in inches
n = number of cylinders
r = gear ratio
D = diameter of wheels in inches
W = gross weight of vehicle in pounds
M = average fuel economy, in miles per gallon
P = horsepower of engine, at a given speed.

1. Ability $= \dfrac{P r}{W D}$.

This simple formula is one of the oldest and perhaps most widely known for estimating so-called ability. Its mathematical value has a direct physical interpretation, in that at a given speed for cars of equal transmission and rear axle efficiencies, it will be proportional to total draw-bar pull per pound of weight. For cars of different transmission and rear axle efficiencies, the formula becomes more or less inaccurate. Acceleration or hill climbing ability of a certain car at a given speed, however, is proportional to excess draw-bar pull per pound of weight over that necessary to propel the car at the given speed as discussed above, so that even as an estimate of this one factor in automobile performance, this formula is hardly tenable. For two very different cars, such for example as a limousine and a speedster, the total draw-bar pull per pound of weight may be the same, yet the excess drawbar pull per pound of weight (and, therefore acceleration and hill climbing ability) be quite different, especially at comparatively high speeds. The use of this formula as is customary, by the mere substitution of maximum engine brake horsepower for P when two cars are being compared, is of little, if any, value. If maximum torque were used, instead, we should come nearer relative hill climbing and acceleration abilities, but even then the results would not be directly comparable. As a formula for estimating complete automobile performance or ability, it does not include the three factors, speed range, fuel economy and riding comfort. As a formula for use as an automobile performance factor it does not include speed range or fuel economy, and is not strictly correct for acceleration or hill climbing ability.

2. Vehicle Coefficient $= \dfrac{8 n d^2 s r}{D W}$ —(Myers, 1915).

3. $K = 14550 \dfrac{d^2 s n r}{D W}$ —(Roebuck, 1912).

4. $Q = 3000 \dfrac{d^2 s n r}{D W}$ —(Thomas).

The close similarity of the above three formulæ will be manifest and they may be considered together. Mr. John Younger has pointed out that "these three formulæ represent piston displacement per pound moved 1 ft., and on the reasonable assumption that every cubic inch of piston displacement represents so many foot pounds of energy, these formulæ give a measure of a car's ability. The greater the displacement per pound moved 1 ft., the greater should be the car's ability to speed, to climb and to accelerate on the particular gear reduction considered." From another viewpoint each of these three formulæ represents total drawbar pull per pound of weight. These formulæ like No. 1 may be of value in estimating total draw-bar pull for cars of the same transmission and rear axle efficiencies, providing their engine efficiencies are equal. Considered as formulæ for approximating acceleration or hill climbing ability, practically the same difficulties appear in the use of these formulæ as in the use of No. 1. The constants in these formulæ are the result of a number of assumptions, which in widely different cars do not hold. The constant 8 in formula No. 2, for example, is based upon the assumption that "all motors will develop a torque in pounds at 1 in. radius equivalent to that of their N. A. C. C. horsepower rating," and that the product of engine efficiency by transmission efficiency "for the average well built car will be about 95 per cent." Even aside from these assumptions, these formulæ give us merely an approximate estimate for total draw-bar pull per pound of weight. In no way are speed range, fuel economy or riding comfort taken into account.

5. $\Sigma = \dfrac{1}{10} \dfrac{d^2 s n r M}{D}$ —(Thomas, 1913).

The above so-called "Sigma Formula" differs from the other formulæ considered in that the factor M (average gasoline consumption in miles per gallon) is included. This M is determined by complete tests and is evidently a proper and reliable factor in performance. The remainder of the formula considered alone $\left(\dfrac{d^2 s n r}{D}\right)$ represents piston displacement per foot the entire car is moved, or from another viewpoint it represents total approximate draw-bar pull. In nowise, is acceleration or hill climbing ability proportional to total draw-bar pull, regardless of weight and the draw-bar pull necessary to propel the car at any given speed. The difficulties encountered with this part of this formula are, therefore, as serious as those for formula No. 1, only more so. Only where cars have the same engine, transmission and rear axle efficiencies, will a formula based upon motor dimensions, gear ratio and wheel diameter give a reliable approximation for total draw-bar pull, and this total draw-bar pull is not, in general, a measure of the acceleration or hill climbing abilities of these cars. In this formula, no account is taken of speed range. The curve obtained, however, by plotting values of Sigma for a car at various speeds as shown in Fig. 5, is extremely interesting. This curve was obtained from comprehensive tests upon a six-cylinder car, bore and stroke

5 by 7 in., gear ratio 2.88 to 1, wheel diameter 38 in., estimated total weight 5900 lb.

6. Ability $= \frac{D}{W}$ —(Brush, 1916).

Where $D =$ excess drawbar pull at any speed over that necessary to propel the vehicle at that speed.

This formula, which may be interpreted as representing excess draw-bar pull per pound of weight, gives an accurate measure of hill-climbing ability, an approximate measure of acceleration. It has been proposed that this excess draw-bar pull D at any speed be determined directly by test upon a level course or speedway by attaching a special dynamometer car or attachment to the rear of the car under test and by means of brakes on the special car, control the speeds. If such special car and dynamometer can be devised, and if the dynamometer under the conditions of high speed incident to such tests were to give substantially steady readings which could be relied upon, this method would be direct and acceptable for the determination of that one item, excess draw-bar pull, which in automobile performance is evidenced by hill-climbing ability or acceleration or both. As a complete automobile performance or ability factor, this formula takes no account of fuel economy or of speed range. It is suggested that this $\frac{D}{W}$ value be multiplied by E and then by S, for the complete factor. On the assumption that the proposed tests for $\frac{D}{W}$ values can be successfully carried out, the proposed factor would seem to be satisfactory.

Discussion Full of Suggestions

C. T. Myers, engineer of the Timken company, presided and opened the discussion. He said that Prof. Fishleigh's factor C (comfort) is not susceptible to accurate determination, although the other factors are and the author has accurately analyzed them. There is no attempt to measure the efficiency, but only to indicate it: "A point which will surely be argued," Mr. Myers said, "is the speed range. Another way of looking at this is to use it in a way that will accentuate its effect on the formula by taking the ratio of the highest speed to the lowest. That is instead of subtracting the lower from the highest speed, the highest speed may be divided by the lower."

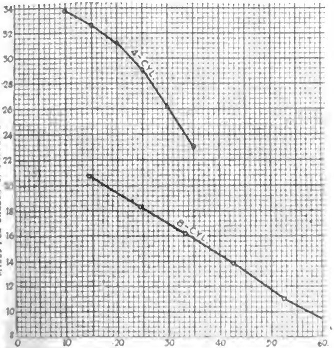


Fig. 3—Fuel economy curve for eight-cylinder car. Fig. 4—Fuel economy curve for four-cylinder car

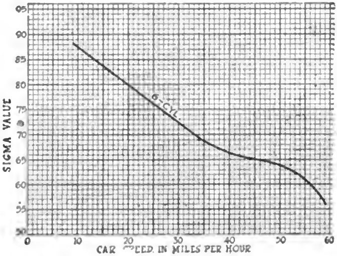


Fig. 5—Sigma values for six-cylinder car sigma formula is $\Sigma = \frac{d^2\ s\ n\ r\ M}{10\ D}$ in which M is average fuel economy and the remainder of the formula represents displacement per foot of travel

K. W. Zimmerschied, metallurgist of the General Motors Corp., stated that he did not see the necessity for carrying out the multiplication of the factors, as the product does not tell anything. In other words, a man may have an entirely different car and get a product of 2520 in one case and 2500 in another. This is only a small difference in the products, while the cars may be widely different. The real purpose is simply to enumerate the qualities and therefore the product is of no use.

A. P. Brush, consulting motor engineer, said that owing to the efforts of the standards committee to determine a formula, it is necessary that great care be taken in the recommendations. He stated that there are a great many objections to the expression as it stands, i.e., $F = S.A.E.$ "Take miles per gallon," he said. "Is it a factor of performance? It is rather an item in the cost of performance and should be figured with such things as first cost of the car, tire cost and general maintenance expense. Let us also take the speed range factor. According to this method of rating a car that has a range of from 44 to 100 miles an hour on high gear, will be just as satisfactory as one that has a range of from 4 to 60 miles an hour. The object of the high speed engine is to give the user the benefit of low speed performance, and this is important to the average user most of the time.

"The $\frac{D}{W}$ (D is excess draw-bar pull at each speer, W, weight) formula is worthy of consideration, as this makes possible the consideration of the speed range as well as the economy.

"Another point that should be settled is what is meant by the lower end of the speed range. You must call the lower end of the speed range that at which the engine will perform smoothly at wide open throttle. The $\frac{D}{W}$ formula is a direct expression of the sine value of the hill that the car can climb."

(*Continued on page 667*)

Willys-Overland's New Headquarters

Administration Building Is One of the Finest Identified with the Industry—Seven Stories—Is 375 By 60 Ft.—Houses Working Force of 950—Economy a Feature of Design

Front of the new administration building just occupied by the Willys-Overland Co., Toledo, Ohio. The building is of steel construction with an equitable brick exterior. There are four passenger elevators and one for freight

TOLEDO, OHIO, Oct. 14—The Willys-Overland Co. has just located in its new administration building, which is one of the finest office buildings connected with the automobile industry. It is a seven-story, brick structure, 375 by 60 ft. and houses a working force of 950 people. All of the administrative offices in connection with the factory are located in the building, which is an architectural model to the industry and well adapted for the work. On entering the building the atmosphere is more that of a huge hotel than an executive building for an automobile concern. On the ground floor is a reception room 100 by 30 ft. resembling the corridor of a large hotel. It is filled with large couches, divans, chairs, etc., and fronting on one side of it are the elevators. The building is served by a system of four Otis passenger elevators, each with a capacity of twenty people, in addition to which is a 5000-lb. freight elevator.

The building is of steel construction with an equitable brick exterior giving a most attractive appearance. It is located directly across the factory from the old offices and fronts on the city boulevard and faces what is known as the Model 75 building, that is, the huge assembly building, 1000 ft. in length, in which the Model 75 is built.

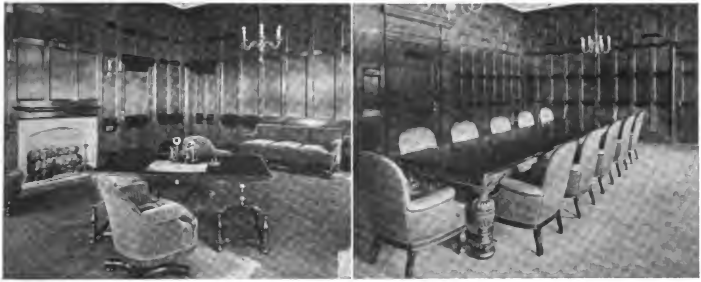
The general layout of the administration building has been worked out with economy in every feature as a foremost requisite. Those departments such as Purchasing, Service, and Traffic are on the main floor, so that the elevator service will not be called upon to serve those departments. These are the departments that have most business visits from outsiders per day.

The second floor is given over entirely to accounting and a novelty is the use of steel furniture throughout. Each clerk sits at a steel table and back of it is a steel cabinet, little higher than the table, in which all of the books, etc., are kept.

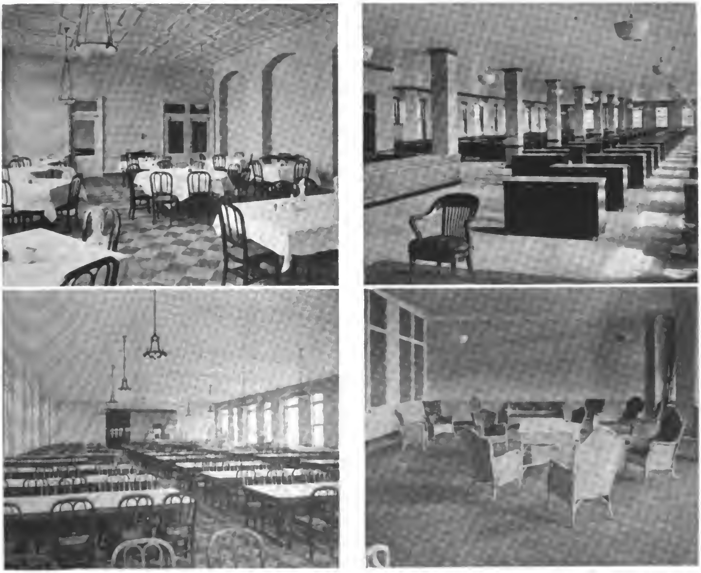
The third floor may be described as the middle floor of the building; there are three below it, counting the basement, which is a level ground floor, and three above it. On this middle or central floor are all the central correspondence files for the entire building; the force of forty or more stenographers occupies a department of this floor;

(Continued on page 663)

General reception room, more sumptuous than the lobby of many hotels



At the left is the private office of President John N. Willys in the new administration building, at the Toledo factory. At the right is the directors' room, where the weighty problems of the big Willys-Overland organization will be threshed out. The conventional heavy table extends the length of the room, giving it an air of dignified importance typical of the accomplishments of the company



Above at the left is one of the private dining rooms for officers and other executives of the company. At the upper right is a glimpse of the accounting department, showing the steel equipment and filing devices. Below at the left is the general dining room or cafeteria accommodating over 600 at one time. Below at the right is the girls' rest room with its white ivory wicker furniture

Automobile Conditions in Europe

Importations to British Isles and Italy Forbidden—70% Duty Into France—Tires Scarce in Neutral Countries—Better U. S. A. Service Needed on Electric Starters and Generators—More Attention Needed in Export Trade

By Peter Steenstrup

¶ Editor's Note:—Peter Steenstrup, representative of the Hupp Motor Car Co. in Europe and Latin-America, has recently returned from a 5-months trip through ten countries in Europe, visiting most of the continent excepting Russia, the Central Powers and Holland. In this article Mr. Steenstrup tells of automobile conditions as he found them.

NEW YORK CITY, Oct. 13—With all the countries in Europe which are not at war, business is generally in excellent shape, and several neutral countries are literally rolling in wealth. With this condition it is not surprising that there is an unprecedented demand for automobiles, and accessories. In filling this demand the U. S. A. is the greatest possible source of supply because scarcely one of the neutral countries can be classed as a manufacturing country. Spain has one or two factories and there are one or two in the Scandinavian countries.

With such a favorable market it is no credit to U. S. A. manufacturers that we are getting the business because there is no other place to buy cars. We are to-day selling our cars cash against document in New York. Generally European dealers are disappointed that our manufacturers have not made active steps toward establishing a more liberal basis of doing business with European neutrals. It would be to our credit to offer more favorable terms of payment now when we are not compelled because of international rivalry to do so. When the war is over international rivalry will require us to give better credit terms, perhaps 90 days. European dealers will then not thank us for giving credit extension because they will realize we will have to do it.

It is further expected by European dealers that we will lay more constructive plans for giving better service throughout Europe. With our highly-developed automobiles using essentially U. S. A. electric starting and lighting systems, a much better service is required. To date our parts manufacturers have done very little to establish that service which is necessary in Europe for their electrical systems. This applies to ignition systems, batteries, starters, generators and horns.

PETER STEENSTRUP
Hupmobile Representative for Europe and Latin-America

This lack of service is bound to react on us as soon as European manufacturers are back in the field. To-day is the time when we should prepare to meet the post-war competition, rather than waiting until terms of peace have been signed.

The question of getting pneumatic tires from neutral countries is one of the greatest obstacles in European car business at present. Norway and Sweden are particularly hampered in this respect to-day. This is due to the fact that during 1915 there was a great deal of smuggling of tires from Sweden to Germany, and now Great Britain, which holds the key to the tire situation for Europe, is getting even and will not ship tires or permit them to be shipped to Sweden. You can ship as many cars without tires as necessary. There is no prohibition of cars, but tires are under the ban. When tires are received they reach these countries in small instalments. In August no licenses for shipping tires into Sweden had been granted for several months.

To-day in Sweden it costs the price of a Ford car in the U. S. A. to buy a set of tires. I saw a dealer in Stockholm on Aug. 10 pay $167 U. S. gold for a 34 by 4 casing. I saw $12 paid for an old 34 by 4 inner tube, with fourteen patches. In addition to tires being very expensive, gasoline is retailing at from 50 to 75 cents per gallon.

There is a possibility that Jan. 1, 1917, may bring some relief in the tire situation with these countries. On that date Great Britain's conventions or arrangements with neutral countries, with regard to automobile tires, expires. It is rumored on good authority that Great Britain by that time will be willing to permit shipments of cars with tires into many neutral countries. If such is permitted it will greatly increase the sale of U. S. A. cars in Scandinavian countries.

The sale of U. S. A. cars in England, France and Italy is practically suspended, except to the governments. The sale of cars in England and Italy, except to the government, is forbidden. You can still sell in France by paying a 70 per cent import duty which is practically equivalent to an embargo.

Among the neutral countries, Switzerland would gladly buy cars but is practically prevented from doing so by the British blockade. Very few outside cars get into the country. What cars Switzerland is building to-day are largely being required by the government.

Business Booms in Spain

Spain is one of the neutral countries where the automobile business is thriving. The country is profiting because of the war and the government is aware of the fact that automobiles and motor trucks are as essential in war as guns and ammunition. The sale of cars in Spain is generally handled from Madrid. Outside of the capital Barcelona is the leading city, and is the greatest manufacturing center in Spain, being known as the Manchester of that country. In the Barcelona zone are more industries than any other part of the country. The city has a population of 560,000 and the streets are well paved.

In Barcelona is the factory of the Spanish automobile company where the Hispano-Suiza car is made. King Alfonso is one of the large stockholders in this concern and the output is largely absorbed by the government. The factory is producing several hundred cars per month, all being four-cylinder models.

Spanish Roads Poor

Spanish roads are generally not good. In the northern country in the summer resort district of San Sebastian are good macadam roads. Outside of large cities macadam roads radiate for upward of 50 miles. Once beyond this zone roads are sandy and rocky. To-day touring in Spain is looked upon as a stunt rather than a pleasure.

U. S. A. cars are selling in good quantities in Spain to-day. Fully 75 per cent of our cars are sold in cities. This is largely due to the fact that city people have profited most by the war. Spain in general wants five-passenger cars. Throughout the country are many body-builders who build closed types as needed. Gasoline is selling at from 50 to 60 cents.

Of neutral countries, perhaps Denmark has profited as much by the war as any other country. It is reported she has made enough to pay off her entire national debt. I was not able to visit Holland, for when I got to England for the second time after traveling through several continental countries, the English government decided I had traveled and seen enough, and would not let me into Holland. I was permitted to go to Norway, Sweden and Denmark, but my passport was stamped "No return to England," so I had to return direct to America from the Scandinavian countries.

The Scandinavian countries, that is Norway and Sweden, including Denmark, have made their money out of various products that have been sold to Allies and Teutons. They let Germany bid against England, and sell to the highest bidder. Some of the products most in demand are foods, fish, minerals and lumber.

Before placing an absolute embargo on the importation of automobiles, England was doing all she could to discourage the use of motor cars for pleasure. Among the emphatic means employed by the British Government in this regard may be mentioned, thousands of huge posters plastered all over London accusing people who used automobiles for pleasure of being "Germans."

Norway a Growing Market

Great Britain is making the best possible use of her sea power to control the movement of all sorts of supplies which might ultimately reach her enemies. Before our automobile exporters complain of Great Britain's efforts to regulate the movement of tires they probably do not know to what extent nearly every line of trade of the small neutral countries are regulated. Norway was prevented for a long time from importing cotton and could obtain it only by agreeing that it would not be used for making fish yarns. In that way Great Britain could regulate the catch of fish and thus indirectly at least prevent this class of foodstuffs reaching Germany in too great quantities. Fish bring high prices in Germany and the unlimited catch and sale of same to Germany would make many more small fortunes in Norway and consequent increased sales of automobiles.

Willys-Overland's New Headquarters

(*Continued from page* 660)

the women's rest room, with a graduate nurse attendant is located here; and other hospital arrangements are on this floor. It is the most convenient, being half way up and down, for the stenographic force which goes up or down to the different offices as required, also for filing, etc.

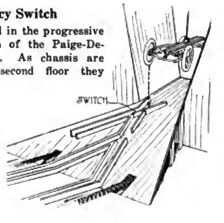
Fourth floor, that is first above the central one, is given over entirely to sales departments, including separate offices for all the departments of sales.

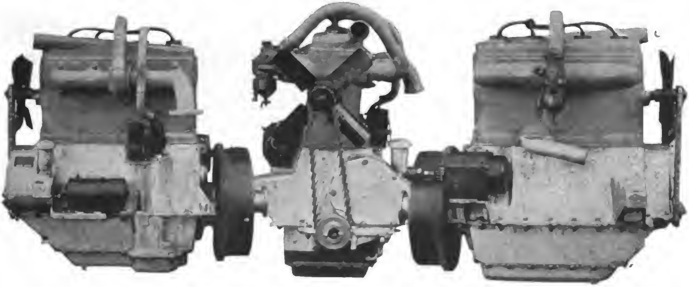
Fifth floor is devoted exclusively to offices of the executives of the firm and board rooms. On this floor the office of President John N. Willys is finished in walnut, and is a model of its kind. The board room, similarly finished, has panelled walnut walls, and the customary ponderous table extending from end to end which carries the atmosphere of a bank board room. All of the vice-presidents and other officers have offices on this floor.

The sixth, or top floor, is a huge cafeteria, with capacity for 200 persons every 30 min. This cafeteria occupies but one-half the floor, the other half being a large auditorium with seating capacity for 600, a stage at one end for moving picture programs, and a dancing floor. The cafeteria has been carefully worked out so as to give efficiency. The luncheon hour ranges from 11:30 to 2 o'clock. It is handled in 30 min. relays. One division of the office takes luncheon 11:30 to 12:30; another 12 to 1; another 12:30 to 1:30; and the fourth 1 to 2. Luncheon prices are very low. The prices are: Meat orders 9 cents; soups 5 cents; vegetables 4 cents; dessert 5 cents; coffee, milk or tea 3 cents. Coupon books worth $2 are used in payment.

An Efficiency Switch

THIS switch is used in the progressive assembly system of the Paige-Detroit Motor Car Co. As chassis are lowered from the second floor they are switched to the right or left track as required. There are two tracks on the lower floor and the switch enables the chassis to be evenly distributed.





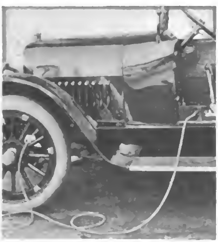
Moline-Knight engine, showing mounting of 6-volt Wagner generator with grounded return, which replaces a 12-volt two-wire type. Also Connecticut ignition distributer which supplants a magneto. Note Auto-Lite starting motor and hot air stove for carbureter

Moline Makes Engine Changes

Abandons Oil Pressure Control—Adopts Battery Ignition in Place of Magneto—Front End Chain Layout Rearranged

THE new model G Moline-Knight four, while it follows the lines of the last model, has several changes in detail, especially with respect to the engine. This is, of course, a Knight type, and the dimensions of 4 by 6 in. are unchanged, but the detail has been modified at a good number of points. The most immediately noticeable change is that the magneto has been replaced by Connecticut battery ignition. The distributer is worm-driven off of the eccentric shaft, which actuates the sliding sleeves, and the same shaft which drives the distributer extends into the crankcase and drives a new type of oil pump which is another departure from Moline practice.

Oil pressure in the Moline-Knight is no longer controlled by the carbureter throttle. In the previous models a lever in unit with the throttle lever opened and closed an oil pump throttle with the purpose of giving a uniform addition of oil pressure with the acceleration of the car. In a few instances it was found that owners had difficulty in understanding this arrangement and abused it by mis-adjustment, consequently a gear-pump has been substituted which gives increased oil pressure as its speed increases.



Moline-Knight tire-pump hose may be attached without lifting the floorboards

The silent-chain system for the front end is no longer a triangular layout. In the model 50 one chain acted through three sprockets, a drive sprocket, sleeve-actuating sprocket and generator-driving sprocket. The new method is to drive the sleeve shaft by one chain and the generator with another.

The exhaust manifold is now constructed to permit the separate exit of gases from each of the four cylinders, this being accomplished by the use of a casting with ports to each cylinder, which replaces a manifold that took care of two cylinders in one part. Better scavenging is the claim for the new principle.

The new intake assembly embodies a hot-air pipe which reaches over the top of the cylinders and connects on one end with a stove on the exhaust manifold and on the other with the air intake of the carbureter. The stove assembly is purely a cold weather fixture and the makers state that it should be removed for summer driving.

The new crankcase is built in halves instead of one casting as in the 1916 model 50. Maximum accessibility is claimed for this construction because it is only necessary to remove the oil pan to permit the complete removal of all the connecting-rods and pistons.

Another step in the way of accessibility is the new location of the combination oil filler and breather pipe, this having been located on the crankcase arm instead of in the center. With the old design the oil filler came directly under the water pipe, making it somewhat difficult to pour in the oil. The cast-aluminum fan has been discontinued and in its place is a pressed steel fan operating on a swinging bracket which permits ready belt adjustment.

All the above mentioned features constitute a change of the larger car to comply more nearly with the specifications of design of the model 40, which was the small car of last year. This latter will be continued with a few alterations which will be announced later.

Something entirely new, however, is the adoption of the Bendix system of starting-motor drive in place of the manual shift which has characterized previous models. This was adopted because of its simplicity, there being less parts in the Bendix shaft assembly than in the manual shifting device. In the electrical system, there is another marked change from the model 50 equipment. The generator is still a Wagner, but it is a 6-volt instead of a 12-volt machine and the wiring has the ground return principle instead of the two-wire system of the previous model. This is another step toward simplicity which has been the goal of the Moline engineering staff in the building up of this new model. The starting motor is an Auto-Lite design.

Moline Universals Used

The Brown-Lipe three-speed selective transmission is still mounted some distance behind the engine and is connected with it through two universals. These universals, however, are of Moline make in this latest model.

The rear axle is a floating type with spiral bevel drive, much the same in construction as on the model 40, but proportionately larger to take care of the additional power and weight in the new car. The gear reduction in the differential is 4 to 1 instead of 4.33 to 1, this higher gearing being made possible by the decreased weight, with an engine of the same size and even higher efficiency. The front axle is a duplicate of the large car of 1916.

The characteristic double-compounded semi-elliptic spring design is retained in the model G. The springs are transverse and there are two of them, one above the other. They are of slightly different length and so different deflection period. The upper has a shackle attachment to the frame at one end and a pin at the other, and the lower has corresponding attachments to the axle. The effect of these two springs is to provide a very flexible suspension and yet roll and jumping is eliminated by the difference in deflection period. One spring damps the other, so to speak, when a severe shock is encountered.

Stewart Vacuum Fuel Feed

A new accessory which alters another principle of design is the installation of a Stewart vacuum tank which supplants the pressure system of the model 50. Gasoline is contained in a round tank instead of a square one and this tank is ingeniously fitted into the rear frame assembly and held in place by steel straps. The tank is fitted with a magnetic gasoline gage.

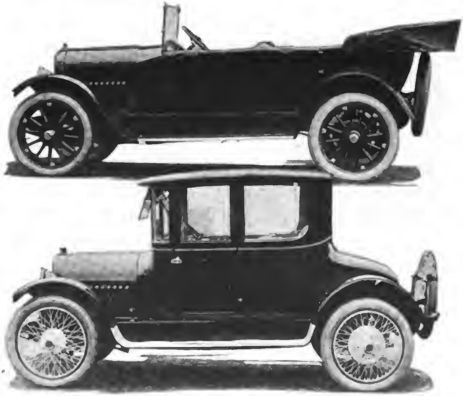
The Brush chassis and frame design in which the side members of the frame were extended to form the running boards is not evident in this model. Instead, the running boards are of wood. The shape of the frame, however, is similar to the previous model with the size altered to take care of the new chassis.

The tire pump mounting shows another well-planned effort to bring all accessories within easy reach. This accessory is now mounted on the gearset, so that the hose may be screwed into the nozzle without lifting the floorboards. The pump-operating lever is located at the side of the gear-shifting lever. In previous models the pump was under the hood and driven from the fan gear.

Double-Cowl Body

The new body marks Moline's acceptance of the double cowl. It is by far the best appearing body that these makers have yet produced. With a rolled-in edge sloping into the rear cowl, a rounded back, front cowl blending into the hood, crowned fenders and the characteristic all-curved line Moline-Knight radiator, the new car is entirely lacking in straight lines and has a massive, comfortable appearance. The sides of the body are 1½ in. higher than in the model 50, permitting lower seating of the passengers within the body which is becoming so much in demand. The upholstery is buttonless and deep. A mahogany panel has been fitted on the back of the rear cowl and in this are two flush rear-seat lights, one on each side. The windshield has been given a slight slant, hardly perceptible yet just enough to further carry out the effect of a total absence of right angles.

The spare tire is carried on a ring which serves the same purpose as a rim; that is, the tire and demountable rim are bolted directly onto it. A locking device is fitted, and this same assembly carries the tail lamp and license bracket. Because of its lighter weight the model G is fitted with 35 by 4½ in. tires instead of 36 by 4½, which size was standard on the model 50. With full equipment the model G sells for $1,750.


Above is the new double-cowl touring body fitted to the new Moline-Knight chassis and below the new coupé with wire wheels

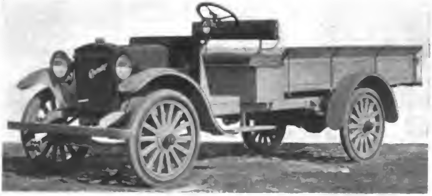
Willys-Overland 75-B Delivery Car

TOLEDO, OHIO, Oct. 16—The Willys-Overland Co. has put on the market the new Overland 75-B chassis fitted with a panel delivery body, selling at $625 f.o.b. Toledo. Features of the chassis which are not commonly found in low-priced delivery cars are the four-cylinder 31½-hp. block engine, electric starting and lighting system and 31 by 4 in. tires.

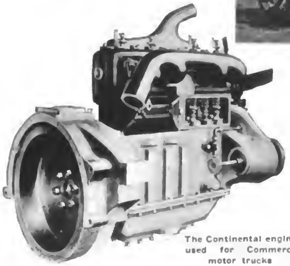
The panel delivery body fitted provides more than 78 cu. ft. of loading space back of the car. As the driver's seat extends only half way across the car there is additional space available extending to the toe board if required, the entire length of the floor on that side of the car being 97 in. The car is light and compactly built, has a short turning radius, making it easy to handle under all sorts of traffic conditions, and is designed to be economical in operation and maintenance. Tests have shown that it will run in continuous service at a cost of 1 cent or less per mile for gasoline and oil, according to the manufacturer.

Commerce Adds 1-Ton Model

Complete Electric Equipment Includes Starter—1-Ton Has Internal Gear and 1500-lb. Model Uses Bevel Drive—Power Plants Employed Are Identical



A 1-ton Commerce chassis selling at $1,175 with open body costing $60



The Continental engine used for Commerce motor trucks

IN addition to the 1500-lb. wagon, the Commerce Motor Car Co., Detroit, is now marketing a 1-ton truck. This is the first departure of this concern, which has been manufacturing vehicles for 7 years, from a single model policy and marks its entrance into a new field of light commercial car work.

Following the customary practice in light-capacity trucks the Commerce 1-ton model E is sold as a chassis, completely equipped with electric starting and lighting and a governor. This list price is $1,175 for the chassis alone and to this may be fitted a wide range of body styles. As standard the Commerce company is marketing an open body at $60 and a body with a four-post top and storm curtains at $100. Deliveries on this vehicle are scheduled for Nov. 15.

As far as the powerplant is concerned this truck is the same as the 1500-lb. chassis with the Continental unit, having a block of four cylinders 3½ in. by 5 in. This is an L-head design of medium duty characteristics and carries the clutch and gearset as a unit plant. Conventional design is used throughout and a good index to the construction of the engine is given in the main bearing dimensions which are: front, 2 3/16 by 2⅞; center, 2 7/32 by 2½ and rear, 2¼ by 3. This gives a minimum crankshaft diameter at the bearings of 2¼ in.

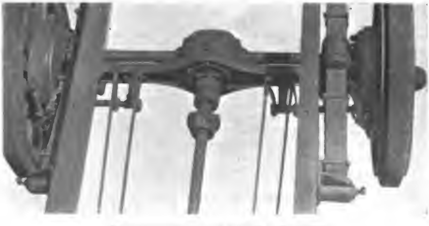
Following the dictates of common-sense in truck motor practice everything about the power plant is as simple as it is possible to make it. The oiling system for instance is a simple splash in which a constant level is maintained by a plunger pump. The only attention that the oiling system requires is to keep it filled with oil to the proper level, and occasionally to flush the crankcase with kerosene. The capacity of the reservoir which is in the lower part of the crankcase is 1 gal.

Fool-proof Ignition System

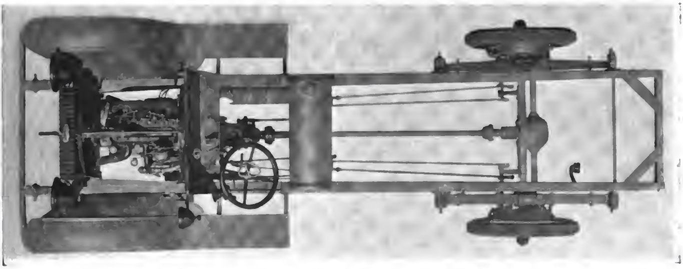
The ignition system is also a fool-proof installation, being a single high-tension Eisemann magneto with even the spark lever removed, as the timing of the ignition is fixed. Cooling is by thermo-syphon in connection with a vertical finned tube radiator with a removable cast top. The radiator construction is qute interesting, being an up-to-date adaptation of the cast tank and side member design. The component parts are illustrated herewith.

Three-Speed Gearset

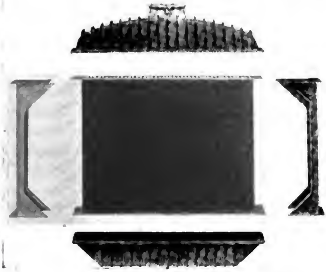
In the bolted-on bell housing are a leather-faced cone clutch and a three-speed selective gearset. From these the drive is transmitted through a propeller shaft and universal joint set manufactured by the Arvac Mfg. Co. The joints are made of drop forgings with felt washers and circular wire springs for retaining the grease. The shaft is hollow, having an outside diameter of 1¾-in. and a wall thickness of 3/16 in. From the rear universal the drive is transmitted to a Torbenson internal gear rear drive carried on roller bearings of Bower and Bock manufacture. A heavy wheel is used with 1¾-in. square spokes and the regular tire equipment is solid rubber of 34 by 3 front and 34 by 4 rear. When pneumatic tires are fitted at an extra cost, the tire



Rear construction of Commerce 1-ton chassis



Showing the substantial simplicity of the Commerce 1-ton chassis



Commerce special form of radiator

sizes are 34 by 4½ front and 35 by 5 rear. The front axle is an I-beam and it is equipped with Bower roller bearings in the hubs.

The frame is a high-carbon steel of channel section. The thickness of the stock is 3/16 in. and, as this material has a tensile strength of from 60,000 to 80,000 lb. per square inch, a high factor of safety is allowed with the depth of 4½ in. The flange width on this frame varies in regards to its position on the car. At the front end it is 2¼ in. at the center 3½ and at the rear 2, giving lateral as well as vertical stiffness.

A double set of concentric brakes is used on the rear wheels. The internal is 15½ by 2¼ in. and the external 16 by 2½ in. These are connected with the brake control mechanism by direct-line linkage and are secured against rattles. The spring eyes and shackles are also secured against wear and looseness by using bronze bushings at all points and protecting these by oil cups.

In the way of fittings and equipment the car is unusually complete for a commercial vehicle. The Remy electric equipment is used for starting and lighting in connection with a Willard storage battery. The carbureter is a Zenith which is also in line with the simplicity of the entire chassis as there are no adjustment points beyond those fixed at the factory. For gasoline feed the Stewart vacuum system is used, operating in connection with a 15-gal. welded steel tank located beneath the driver's seat. The lamp equipment consists of side and tail running lights with a powerful searchlight for picking up house numbers, street signs, etc. The standard bodies have a loading space of 44 by 110 in.

Automobile Performance

(Continued from page 659)

J. B. Replogel, director of research, Remy company, asked what we would do with the formula after we got it. The *C* factor must be taken into consideration and therefore we would have to assume units for noise, vibration and endurance.

William B. Stout, sales manager Scripps-Booth, said that in all probability the *C*, or comfort factor, would be the deciding one. It would be impossible to reach the same effect by formula that riding in the car would secure. A formula also leaves out the element of personality, which is largely to be desired and which is a factor in the sales of a car company in the same way as it is of a piano concern. Even the height of the car is responsible for impression in riding and Mr. Stout pointed out that the effect of riding in a car which is too high or too low has the effect of nervous strain which produces mental fatigue that would never be registered in the performance formula.

C. C. Hinkley, engineer of the Chalmers company, stated that when cars are designed they are designed around a formula and for that reason there is no good reason why the same formula could not be used as a rating method. The formula he uses is:

$$\frac{\dfrac{D\times R}{W\times d}}{T}$$

Where D, is displacement, R is gear ratio; W, weight; d, wheel diameter and T, the time in seconds necessary to accelerate from 5 to 50 m.p.h.

V. R. Heftler, president of the Zenith Carbureter Co., stated that it may after all be better to give performance rating in the form of a curve rather than in a mathematical expression.

E. M. Planche, chief engineer of the Dort company, stated that he used the $S\times A\times E$ formula divided by L, the low, high-gear performance with very good results. The wind resistance factor should also be regarded important.

O. E. Hunt, assistant engineer of the Packard company, said, "No engineer would contend that performance is the sum total of car value. Besides this it is made up of reliability, comfort and appearance. The factors involved in performance are speed range, acceleration and economy, *i.e.*, *S. A.* and *E.* Only the latter can be measured mathematically and can be considered in a formula."

Fuel Feed By New Method

Cylinder Pressure Employed To Fill Supplementary Tank in Turn Feeding Carbureter by Gravity

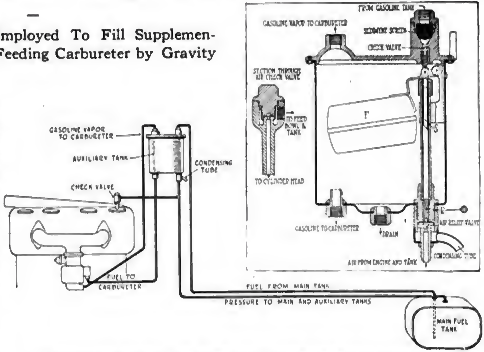


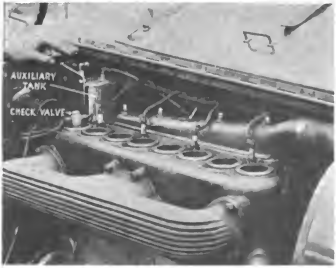
Diagram of Church fuel feed system with a section through the auxiliary tank

THE Church fuel feed system is a new method combining gravity and pressure feed in an ingenious way. It involves a supplementary fuel tank which may be mounted on the dash or other convenient point, and from this gasoline is fed directly by gravity to the carbureter. A float level is maintained within the supplementary dash tank.

It differs from one other system in that instead of using the suction of the engine to transfer fuel from the main tank to the auxiliary tank, this is maintained by an automatically regulated pressure caused by the compression and explosion pressure in one cylinder. This pressure is obtained through a very ingenious check valve mounted usually in place of the petcock in the rear cylinder and through which the burned gases maintain pressure on the main fuel tank and force gasoline to the auxiliary tank in the same way that fuel is forced directly to the carbureter in the conventional pressure system.

It has the distinction, however, that a constant gravity feed is provided to the carbureter and there is no handpump required.

A feature of the system, which will have the most general appeal, is the fact that an adequate supply of gasoline is assured to the carbureter, even though the auxiliary tank be empty at the time of start, and even though the main fuel tank may have been open for filling and the pressure thus relieved. This comes about through the fact, first, that the fuel in the carbureter float chamber is more than sufficient to start the gasoline running from the main tank to the auxiliary tank, where it runs by gravity to the carbureter and, second, that in the absence of sufficient fuel in the carbureter float chamber to start the engine, the operation of the starter for 15 sec. or less will generate pressure sufficient to put fuel in the auxiliary tank.



Church fuel feed system on engine, showing auxiliary tank on dash. Note check valve

Flow Is Constant

A point that is considered most important by the inventor is the fact that, being independent of engine suction, the engine can be run indefinitely on wide-open throttle without diminution in the fuel supply, caused by the combined decrease in suction and increase in fuel demand which occurs with wide-open throttle. On the contrary, the system is arranged so that increased demand on the auxiliary tank automatically permits increased pressure in the main tank, thus increasing the flow of fuel to the auxiliary tank.

That the system is capable of supplying fuel under conditions of maximum demand was demonstrated recently in an official A. A. A. test on the Chicago Speedway under the direct supervision of F. E. Edwards of the A. A. A. technical committee, and witnessed by a representative of THE AUTOMOBILE. In this test, a Mercer 22-70 roadster, fitted with the Church system was driven a distance of 10 miles in a total elapsed time of 7 min. and 58.4 sec., an average speed of 75.4 m.p.h., with a maximum speedometer reading of 84 m.p.h. As may be imagined, this required wide-open throttle practically the entire 10 miles, and there was no spitting or other evidence of starvation during the trial. At the end of this distance the auxiliary tank was still full.

The system is arranged so that the ordinary maximum pressure is not over 1½ lb. per square inch, but in the test referred to, the pressure as indicated by a gage on the dash, ran up to nearly 3 lb. indicating the automatic increase in pressure to meet an increased demand. In order to further illustrate this point, a Jeffery six touring car was fitted with a mast, upon the top of which the Church tank was installed, so that the tank was 10 ft. 9 in. above the level of the main tank. With the auxiliary tank empty, pressure relieved from the main tank and the engine dead, it required 14.4 sec. to get fuel into the auxiliary tank after the starter button was depressed, at the end of which time the pressure indicator showed a pressure of 1½ lb. per square inch. In running the car at a speed of 55 m.p.h. a maximum pressure of 3 lb. was registered.

Essentially a Closed System

Another advantage with which the system may be credited comes from the fact that the system is essentially a closed system, and neither the main tank nor the auxiliary tank is open to the air; consequently, there is no chance of taking in road dust. The system is closed in another respect, in that a vent is provided in the top of the auxiliary tank, but this vent is connected to the air intake of the carbureter, so that any gas which evaporates from the system passes directly into the carbureter through the air intake, and thus adds its quota to the fuel supply instead of being wasted. Inasmuch as the evaporation of gasoline over a warm engine is a considerable fraction of the fuel possibility, this feature is an item of economy.

The diagram on the opposite page shows the general layout of the system, together with a cross-section of the Church tank on the right, and the air check valve on the left, while the illustration at the bottom of the page shows the tank installed on a Mercer car. In the sectional view it will be noticed that the pressure line is in the form of an inverted T with the check valve at one end, the main tank at the other and the Church tank at the end of the stem. It is in the Church tank that the pressure regulation occurs, and it is determined by the position of the float *F*. As the float descends with lowering of the gasoline level, the stem *S* moves downward, pushing downward on pushrod *R*. This in turn seats the air relief valve and prevents pressure escaping through the condensing tube, so that, with the float in its lowest position, all of the pressure from the check valve goes into the main tank.

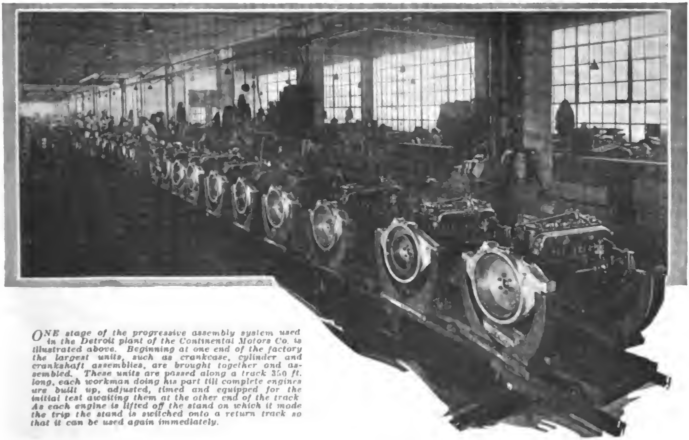
When the float is at its upper position, the air relief valve is forced upward by the pressure, permitting the latter to escape through the condensing tube. The conical form of the air relief valve graduates the amount of pressure being used in proportion to the position of the float; that is, in proportion to the height of the gasoline level in the auxiliary tank. It will be noted that a gasoline check valve is provided at the gasoline intake operating in harmony with the air relief valve. It will also be noted that cleaning arrangements are accessible, for the sediment screen can be removed without disturbing the tank, as can the air relief valve.

The designer attributes the possibility of this system to the design of the check valve. This is a flat nickel disk, 1/32 in. thick, and having a maximum opening of only 0.003 in. It is calculated that the valve takes approximately 0.005 of the cylinder volume.

Sight Feed Furnished

In connection with the system a gasoline sight feed on the dash is supplied if desired, and this has the advantage of giving a warning that the main tank is empty, at which time there is approximately a pint of fuel in the auxiliary tank which serves as a reserve. The system was developed by Edmund S. Church, Automatic Carbureter Co., Chicago, Ill.

Progressive Assembly Used for Continental Engines



ONE stage of the progressive assembly system used in the Detroit plant of the Continental Motors Co. is illustrated above. Beginning at one end of the factory the largest units, such as crankcase, cylinder and crankshaft assemblies, are brought together and assembled. These units are passed along a track 350 ft. long, each workman doing his part till complete engines are built up, adjusted, timed and equipped for the initial test awaiting them at the other end of the track. As each engine is lifted off the stand on which it made the trip the stand is switched onto a return track so that it can be used again immediately.

A corner of the Studebaker custom body department, showing bodies being trimmed

Studebaker Custom Bodies

Demand for Special Styles Leads Factory To Install Custom Department—Represents Saving

BUYERS of Studebaker cars are no longer confined to the limitations of stock bodies. Owing to the increasing demand for individuality in external appearance, as manifested on the part of purchasers of its cars, the Studebaker company has made the departure of incorporating within its plant a custom body department in which the range of ideas of purchasers can be met with a corresponding style of body in both open and closed models.

Heretofore automobile manufacturers who are classed among the big producers have done a relatively small amount of custom business and where it has been done the bodies have been bought from builders outside the organization. In 1913 the Studebaker company started a body department of its own in which the stock bodies were made, but up to the present time the custom-made bodies have been purchased on the outside.

During the last year there has been a rapidly increasing demand for special body design and it has been felt that the expense of organizing the custom body department will be immediately met by the increasing demand for these bodies. This has already proven to be the case.

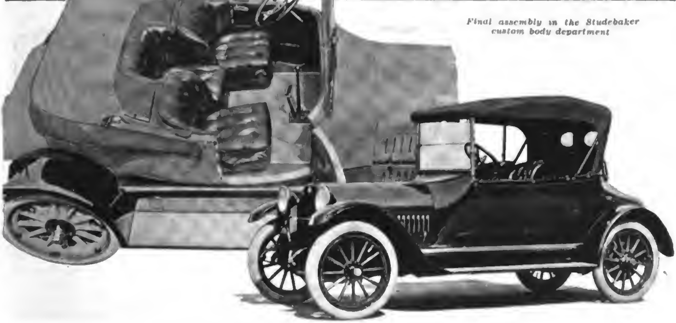
The method of procedure in securing the specially-built bodies is for the purchaser to describe the type he desires. He is then furnished with a rough sketch prepared by the Studebaker designers and when this is approved it is drawn to full size before the structural drawings are made. In carrying out the work of producing these new bodies, several distinctive shapes have been created, and in each case special style tops have been designed to accommodate the body contour.

Of chief interest to the purchasers is the fact that the selling price of the completed product is below the combined price of the chassis and a similar body purchased outside because of the elimination of the middleman's profit. The deviations from the stock body are not only in shape and seating arrangement, but also in color. The standard body is dark blue, while the custom-made bodies are finished in any color scheme that may be desired. The materials used in the construction of these special bodies are carefully selected in the same manner as they are by any of the custom body manufacturers, and although the price of these special jobs will range from $100 to several hundred dollars more than the stock body, there is an ever increasing number of buyers who are willing to pay the difference.

Some of the special bodies which have already been produced are shown in the accompanying illustrations. One of these is a three-passenger cloverleaf roadster which is characterized by the fact that the center seat is not placed as far back as is usual in the three-passenger cloverleafs and hence allows a maximum amount of sociability in seating with the minimum of body length. The small compartments formed on either side of the center seat by its staggered arrangement, which spaces are sometimes allowed to pass entirely unutilized, are utilized for package carriers and can be reached by lids which set

Where the metal-working is done. Bodies are of sheet aluminum

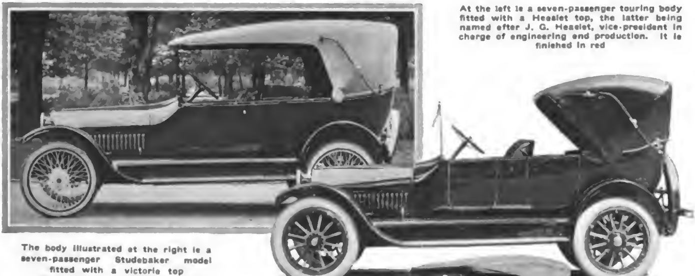
Final assembly in the Studebaker custom body department



Above at the left is a three-passenger cloverleaf type of body made in the Studebaker custom body department and fitted to a standard chassis

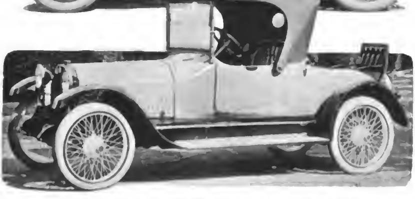
At the right is a custom-built four-passenger roadster design mounted on a Studebaker chassis. This car is entirely a product of the company's factory

At the left is a section of the wood-working shop in the new custom body department of the Studebaker factory. The sheet aluminum bodies are fitted over the wooden frames, parts of which appear in the illustration



At the left is a seven-passenger touring body fitted with a Heaslet top, the latter being named after J. G. Heaslet, vice-president in charge of engineering and production. It is finished in red

The body illustrated at the right is a seven-passenger Studebaker model fitted with a victoria top



A custom-made roadster produced by the Studebaker custom body department. Note the lackey seat in rear for a servant. When not in use this seat folds into the rear deck, leaving the surface smooth

in from the top, a convenient arrangement.

An example of special top construction is shown on a seven-passenger body. This is finished in red and the top itself is what might be called an extended victoria, as it opens with the exterior bows in the same manner as a victoria top, but the peak is extended to the top of the windshield. A top somewhat on this style is shown on a custom-made roadster body which is fitted with a rather novel lackey seat in the rear. The extra seat is primarily intended to accommodate a servant and when not in use it is folded down out of view. The feature of the seat is that the part which folds up uncovering the seat well forms a convenient back rest for the occupant. A particularly wide door is used on this model and the curvature of the side line of the body is also very well worked out.

In the way of special roadsters, the four-passenger design has proved to be quite popular. The type shown in the accompanying illustration is exceptionally roomy and almost approaches a close-coupled touring car with the exception that there are no rear doors, the entrance being through the front and between the divided front seats. No difficulty is found in seating two passengers in the rear seat of this body, as it is of generous width and far enough removed from the back of the front seat to allow the passengers plenty of knee room.

A rather staid and formal type of body is illustrated in the seven-passenger design with victoria top. This is a very popular design with ladies who utilize it for afternoon calls and shopping, giving an effect of an open town car. As will be noted, it is equipped with bumpers both in the front and rear, in order to take care of the minor collisions which often occur under conditions of crowded traffic.

Miniature Racing Cars Make 70 M.P.H.

TEN miniature racing cars, using Indian motorcycle engines and 20 by 4-in. Goodyear cord aeroplane tires on miniature wire wheels, attained a speed of 65 to 70 m.p.h. in a series of races held recently at San Francisco. As can be seen from the illustration published herewith, these little cars were constructed in accordance with the latest dictates of design as adopted in the standard speed creations now breaking records at over 100 m.p.h. on the speedway circuit. While very lightly built, they are made low to keep the center of gravity near the ground and the bodies are built to offer minimum resistance to the wind. Although the tires used were not built for race track service, they stood up excellently under the strains of high speed work, as experienced in the contests fought out by the Lilliputian racing cars.

Ten miniature racing cars which battled for supremacy in a series of races held recently at San Francisco

Resta Wins 250-Mile Grand American Race

(*Continued from page* 655)

Hudson to such an important position in the Sheepshead Bay Race, drove the last 150 miles on five cylinders, and finished in tenth position. He broke a bushing in the valve lifter assembly and after 20 minutes of frantic effort, he and his mechanic removed the lifter guide and re-entered the race with one valve in operation.

Nine Stops for Plugs

Spark plugs again had a hand in swelling the number of pit stops. There were nine stops for plug changes.

To-day was a day for fires at the Maywood track. The Crawford with its unlucky 13 was the only one which was serious, but the other two had possibilities of danger. Devore's Duesenberg caught on fire early in the race at the pit when the driver had flooded things in general in working with his carbureter. When he finally started the engine the gasoline around the engine caught fire from the backfire and a lively conflagration was started. Luckily this was almost in front of the J-M pit and the fire extinguishers had the flames out before they had gained any headway.

The other fire was an incipient conflagration which started from a carelessly thrown match or cigar in the bunting which decorated the front of the grandstand. Attendants had the burning bunting ripped off before any damage was done and there was little excitement in the grandstand. Probably only a few of the spectators, and those immediately behind the place where it occurred, knew anything had happened.

Race Well Handled

Aside from this there were no untoward accidents and no possibilities of any other than the usual risk when a score of cars are traveling at high speed. The race as a whole was very well handled, the track perfectly guarded, the timing seemed perfect, although the scoreboards and announcing were many laps behind the progress of the race. The scoreboards were the worst in this respect, being neither up to date nor always correct.

DePalma was not the only driver who had hard luck after a wonderful showing. Wilcox with only one lap to go to finish in fourth place had to withdraw with a broken connecting-rod. Galvin very nearly had a similar experience, as his car went out while he was making an additional lap after he had been flagged in fourth, and had to push his car part way around the course.

Mulford, who was slated to drive a Duesenberg, did not appear at the starting line and Devore took his place. The Ben Hur, which was a local entry, and fathered by President Reid of the speedway, was not in shape to start. This was to have been driven by Louis Chevrolet. Rickenbacher's Maxwell was not in the best of shape when he started, and much credit is due him for jockeying it into third position.

Attendance Under 10,000

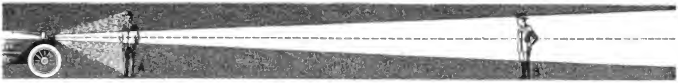
The attendance at the race is judged as below par. It is regretted that more than 8000 to 10,000 did not see the birth of this particular race, the Grand American. But if such another race as this of to-day is ever foreseen in the announcement of an event at the Chicago speedway, the fame of the performance to-day will guarantee a record-breaking gathering.

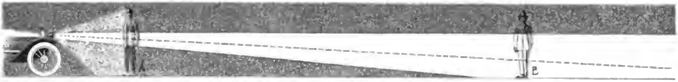
Everywhere were sportsmen and sportswomen. That is the impression the Grand American would probably give most general observers. Most of the crowd were automobilists, if the parking space can bear witness to it, for back of the stands cars were parked within touch of each other along practically the entire stretch there. Enterprising guardians at the entrance to the speedway reaped dollars for space in vacant fields nearby, vacant fields that were well filled by 2 o'clock. As usual the allotments infield showed many cars.

Resta's car was equipped with Silvertown tires, Miller carbureter, Bosch magneto, K L G plugs, R-W wheels, Levett pistons, and used Oilzum. Aitken's car used a Zenith carbureter, Goodyear tires, Bosch magneto, K L G plugs, R-W wheels, Levett pistons, and used Oilzum.

Times Every 20 Miles of 250-Mile Grand American Race at Chicago

Car	Driver	Miles 20	40	60	80	100	120	140	160	180	200	220	240	250	M.P.H.
Peugeot	Resta	11:36	23:06	34:28	45:56	57:19	1:08:42	1:21:12	1:32:42	1:43:50	1:53:08	2:07:01	2:18:30	2:24:16.68	103.99
Peugeot	Aitken	11:37	23:08	34:29	45:56	57:20	1:08:43	1:20:10	1:31:38	1:43:06	1:54:53	2:07:03	2:18:38	2:24:33.61	103.65
Maxwell	Rickenbacher	11:39	23:09	35:45	47:26	59:55	1:10:20	1:20:48	1:32:20	1:45:25	1:56:57	2:08:29	2:20:05	2:26:52.76	102.08
Premier	Lewis	12:19	23:16	36:30	47:52	1:00:01	1:13:22	1:24:07	1:36:14	1:49:24	2:01:28	2:13:16	2:26:36	2:32:28.93	98.37
Maxwell	Henderson	12:02	24:13	36:22	47:35	1:00:57	1:13:05	1:25:12	1:37:27	1:49:23	2:01:19	2:13:14	2:26:41	2:32:31.39	98.34
Premier	Galvin	12:20	23:24	36:45	47:55	1:00:03	1:13:24	1:25:22	1:37:28	1:49:35	2:01:38	2:13:41	2:27:07	2:33:20.50	97.81
Duesenberg	Devore	12:00	23:09	36:18	50:51	1:02:36	1:17:36	1:32:36	1:47:14	1:59:09	2:11:49	2:23:45	2:35:53	2:45:35.43	90.58
Ogren	Burt	11:38	23:14	37:16	51:00	1:03:39	1:17:25	1:36:06	1:48:41	2:03:40	2:17:35	2:30:08	2:37:44	2:52:05.35	86.66
Erbes	Gable	11:51	24:06	36:19	51:53	1:06:37	1:21:36	1:38:14	1:52:22	2:08:09	2:22:54	2:38:38	2:56:23	3:04:52.23	81.13
Hudson	Vail	12:26	23:06	36:19	48:29	1:23:13	1:37:31	1:50:36	2:06:12	2:20:23	2:32:28	2:46:46	2:58:55	3:05:37.37	80.81
W. Duluth	Rawlings	12:09	24:07	36:12	47:38	1:00:29	1:26:42	1:41:05	1:55:22	2:10:55	2:55:16	2:39:46	3:02.45	Flagged	
Duesenberg	Busane	12:31	29:04	42:05	54:35	Running at finish—flagged									
Peugeot	Wilcox	11:59	23:52	35:38	47:18	58:56	1:10:35	1:22:16	1:34:04	1:45:49	1:57:42	2:09:45	2:21:26	Out, broken connecting-rod	
Peugeot	DePalma	11:34	23:03	34:23	44:37	55:50	1:07:08	1:19:37	1:33:00	1:43:25	Out at 194th mile, broken valve				
Ostewig	Ostewig	11:53	30:55	52:12	1:21:28	1:37:34	1:50:36	2:10:16	2:23:58	Out 172nd mile, slipping clutch					
Crawford	Kline	12:03	23:09	36:38	47:45	1:00:05	Out 112th mile, broken crankshaft								
Crawford	D'Alene	11:38	23:31	36-17	56:24	Out 90th mile, broken shaft									
Duesenberg	Milton	11:45	23:05	Out 42nd mile, clutch facing torn out											
Hoskins	Hughes	11:37	....	Out 40th mile, broken connecting-rod.											





Above—Fig. 1—Diagram of the light cast by a good lamp, the direct rays from the bulb furnishing adequate illumination without glaring to eyes outside the limits inclosed by the heavy lines. Below—Fig. 2—Tilting the lamp downward so that the edge of the beam, instead of its center line, is parallel to the ground, eliminates glare

Eliminating Glare Is Easy

A Simple Language Explanation of What Causes Glare and How to Prevent It—What S. A. E. Is Doing To Assist Manufacture of Non-Glaring Lamps

By A. Ludlow Clayden

Chairman S. A. E. Standards Committee

GLARE from an automobile headlamp is caused by the concentrated rays in the beam of light striking the eye of the observer and preventing the lesser light from illuminated objects close to the lamp from affecting the eye strongly enough to give vision. A headlamp lights up objects on the road. An observer facing the lamp can see those objects as long as the reflected light reaching his eye is not overpowered by the light coming direct from the lamp.

Provided the direct light is kept out of the eyes of the observer, the stronger the light that the lamp casts on the road the better can the road be seen by the observer facing the lamp as well as by the driver of the car behind it.

Thus to make the night use of automobiles safe, it is as requisite to have enough light thrown on the road as it is to prevent too strong a light from being cast into the face of anyone on the road.

Arrangement Is Everything

A properly arranged lamp of great candlepower will be less disconcerting to anyone approaching it than will an improperly arranged one of small candlepower.

The light of a headlamp is a concentrated beam surrounded by a general spread of unconcentrated light. All that we need to do to eliminate glare is to keep that concentrated, central beam so directed that none of its rays reaches the eyes of a person in front of the lamp, the general spread of unconcentrated light will be helpful and not harmful.

This can be done very simply if the lamp is sufficiently well made. If the lamp is badly constructed it is impossible, not merely difficult but impossible in the fullest sense. Just why this is will be shown later.

Fig. 1 is a diagram of the light cast by a good lamp. The direct light from the bulb illuminates objects surrounding the lamp and close to it. The concentrated light does not touch the road for some distance, not till the beam has spread out. The edges of the concentrated beam are shown by heavy lines, and the center line of the beam by a dotted line. The lamp will not glare to anyone whose eye is outside the limits inclosed by the heavy lines.

With the lamp placed square to the car this means that a pedestrian will not notice any glare when the car is close to him, but he will notice it when the the man *B* is unable to see anything except the lamp and suffers extremely. This is because the upper edge of the beam is not as high as *A's* eyes but is higher than *B's*.

All we need to do then, is to so set the lamp, or so construct it that the upper edge of the beam cannot ever rise as high as a man's eyes however far away he may be.

Therefore, if we tilt the lamp downward as in Fig. 2, so that the edge of the beam is parallel to the ground instead of the center line of the beam, we have cured that lamp of glaring so far as any approaching pedestrian or driver is concerned.

This seems too absurdly simple to be true. It is true enough though *if* we have a lamp that really does give a beam with a sharp edge. The bulk of the trouble with headlamps is that they cast irregular beams and it is the purpose of the Society of Automobile Engineers to define limits for lamp manufacture that will make the beam sufficiently accurate to enable simple lamp adjustments to give the upper edge of the beam its proper position without uncertainty.

The lamps as made to-day are not reliable, because while any one lamp may be set to give the correct light distribution with one bulb, when the bulb is changed the light may alter altogether. This is because the position of the beam changes as the filament of the lamp is moved.

Fig. 3 shows the same lamp with the same setting and the sort of light it will give when the bulb is moved so as to put the filament into different positions. At *A* we have the right spread of light. At *B* the filament is too far forward and at *C* it is too far back, the result in either case being to widen the beam so that it is no longer within safe limits; thus converting a non-glaring lamp into one which will glare very badly. If the filament is truly in the central axis of the bulb we can cure this by focussing.

The average man is so helpless when it comes to focussing that he would be better off almost without any focussing device whatever, for he then would not maladjust a good lamp which he is likely to do if the chance is given him.

By adding to the cost of manufacture of bulbs a little they can be produced so that adjustment is not necessary. So that any bulb will go in any one reflector and give the same sort of light as its predecessor. This means that one reflector or focussing adjustment would last the life of the lamp.

Next comes the reflector itself. If this is pressed accurately to shape the beam of light will be true and handlable, but if the reflector is irregular, of one curvature at one place and another somewhere else, then the beam will throw out odd rays of glaring light. This means that limits of accuracy should be imposed upon reflectors.

Another thing about reflectors is the kind of curvature they have. If a reflector is very deep, then moving the filament of the lamp has less effect on the beam than when the reflector is shallow. Some of the reflectors in use to-day are so shallow that even an expert in a laboratory has difficulty in adjusting the bulb so as to get a proper beam. This means that if we hold the bulb tolerances down to say 1/64 in., the reflector should be deep enough so that a 1/64 in. variation of filament position makes no difference to the light. With a bulb held to tolerances, and a reflector held similarly we can be certain that a lamp once set properly will remain set properly.

So much for keeping down glare. There is something else just as important, however, and this is to insure enough light for driving that will be safe to the car carrying the lamp as well as to other road users. This means that the car must throw a light far enough ahead to make clear any objects on the road within not less than 200 ft. and that the sideways spread of the beam must be enough to illuminate objects at the sides of the road. The man meeting the car wants to see where he is walking just as much as the driver wants to see where he is steering.

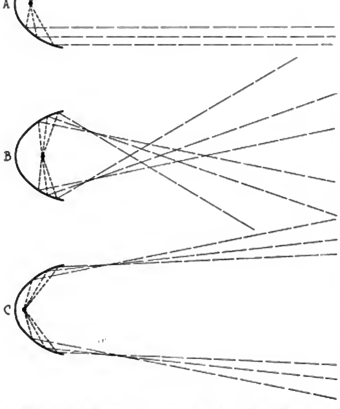


Fig. 3—The same lamp as considered in Figs. 1 and 2 with the same setting and the light it will give when the bulb is moved so as to put the filament in a different position

Adequate Light Required

This means that in making any regulation about lighting it is essential to specify enough light as well as to specify the direction of that light. The idea that glare could be cured by abolishing lamps is good enough as far as it goes, but it would merely substitute worse dangers for present ones.

Herein we find an objection to the simple method of directing light by tilting the lamp, for a tilted lamp will need to be intrinsically more powerful than an untilted one if we are to get the same *desirable* light on the road. Why this is is very easily seen from Fig. 4. This is an exaggerated diagram of the effect of tilting. With the parallel set lamp the beam strikes the road a long way ahead, when we tilt the lamp it hits the ground soon, and after the beam has hit the ground it is used up, it is no longer of much use. The middle of the beam is its brightest part, so we want to have the middle line hit the road as far ahead as we can.

Suppose we want to have it hit the road 200 ft. away and are compelled to tilt the lamp so that it strikes the ground at 150 ft., then to get the same light on the road we must increase the brilliancy so that the ray which does strike the road at 200 ft. with the tilted lamp is as bright as the middle ray of the untilted one. There are ways of overcoming this, but most of them are patented at present. So the simple thing to do is to put up with the loss of efficiency and leave it to the manufacturers to work it out for themselves.

The electrical equipment division feels that by specifying the proper tolerances for bulb manufacture and by specifying those for reflector construction, they can insure the production of lamps that only require to be tilted in order to be non-glaring. The following is an ideal of illumination to insure safety both by the provision of enough light to show the road and things upon it, and to prevent glare:

"A headlamp of an automobile will give an adequate light combined with elimination of glare when:

"1. The light is sufficient to reveal any person, vehicle or substantial object on the road straight ahead at a distance of 150 ft.

"2. There is sufficient side illumination to reveal any person, vehicle or substantial object 10 ft. ahead of and 10 ft. to one side of the lamp.

"3. The headlamp is so arranged that no portion of the reflected beam of light, when measured 75 ft. or more than 75 ft. ahead of the lamp shall rise above 42 in. above the level surface on which the vehicle stands."

This is the ideal, and it is attainable by limiting the tolerances in bulb manufacture, limiting the form and the degree of inaccuracy of the reflector and, finally, by tilting the lamp.

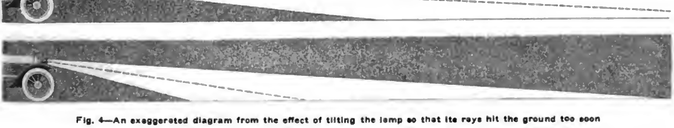


Fig. 4—An exaggerated diagram from the effect of tilting the lamp so that its rays hit the ground too soon

The Rostrum

Finding Differential Gear Ratio

EDITOR THE AUTOMOBILE:—Kindly advise how to find the gear ratio of a differential without disassembling. A Chalmers 6-30 is geared to 5 to 1 on direct. What would be the correct way of ascertaining this ratio without disassembling? If I jack up one rear wheel and put transmission in direct or high, then turn the motor by crank one revolution, and the jacked wheel only turns half way around, why do they say the engine turns one to the rear wheel's five times? Please explain.

West Chester, Pa. W. H. W.

—The gear ratio of 5 to 1 means 5 revolutions of the engine to one of the road wheels. When the differential is operating as it must be with one wheel stationary on the ground and the other turning then the rear axle ratio will only be half what it is when both wheels are turning. If your rear axle ratio is 5 to 1 you will find that with one wheel jacked up it requires 2½ turns of the engine to give you one full turn of the back wheel.

A better way is to turn the back wheel and count the number of turns made by the propeller shaft. You can usually do this by watching the universal joint. Mutiply this number of turns by two and you will have the two ratios.

Engine Needs Thorough Overhauling

Editor THE AUTOMOBILE:—I drive a 1911 Reo that has been run about 16,000 miles and seems to give as good service now as when it was new, with one exception. The third and fourth cylinders pump oil, the fourth one being the worst, so that I have to clean the spark plugs and scrape out the cylinders every 80 to 100 miles, else the engine will develop a very perceptible knock when pulling up grade.

The compression seems as good as when the car was new, but the third cylinder never did have as good compression as the other three. The fourth cylinder has good compression though it is very bad about pumping oil and fouling spark plug, and so far as I can tell, it is the cylinder that produces the knock.

Will you kindly tell me how to remedy this? Would a new set of cylinder rings do the work, and if so, what kind would be best suited for the Reo engine?

Browning, Mo. J. P. B.

—Probably your engine requires a thorough overhauling. If you cannot get equal compression in each cylinder by grinding the valves it will be necessary to examine the pistons and piston rings and also to measure the cylinders to see whether the latter have worn oval shape. If they are out of round it will be necessary to have them reground to fit oversize pistons with new piston rings. If the cylinders are perfectly round the trouble might be reduced by fitting one or two of the special rings of which there are now so many on the market.

The trouble could also be caused by dirt in the oiling system. Make sure that this is quite clean, especially that the oil returns from the crankcase to the oil reservoir are not clogged. You should wash out the whole crankcase very thoroughly with kerosene.

If you find the pistons and cylinders in perfect condition, have the lubricating system absolutely clean and still have not entirely cured your trouble, you could file the dips on the lower ends of the connecting-rods so that while they will still dip into the oil as deeply as before their lesser width will prevent so large a quantity being splashed.

Lubrication Is Provided on Grades

Editor THE AUTOMOBILE:—I have a 1916 Studebaker six-cylinder car which is lubricated by a circulating splash system. A gear pump draws the oil from the rear of the crankcase. If the oil is allowed to become a little low it will not cover the suction end of the pipe when descending steep grades. How long will the supply in the splashed troughs lubricate the engine when the pump is not feeding?

2—When there is a full supply of oil in the crankcase, it is said that there is too much lubrication in the end cylinders. Is it possible for the oil to rise so high at the ends of the crankcase that it will cover either No. 1 or No. 6 splasher troughs on grades? If not, how could a full supply cause excessive lubrication?

Denver, Col. C. E. R.

—Considering that when descending steep grades the engine is not delivering any power there is no need to worry about the condition of the oil. There will be plenty of oil throughout the engine to keep it lubricated for the longest descent.

2—It is practically impossible to design an engine for splash lubrication which will not load the end of the crankcase when the engine is tilted through a large angle. Actually to cover the splasher troughs would require a degree of tilt equivalent to an extremely steep hill.

Continental Engine in 1917 Overland

Editor THE AUTOMOBILE:—Kindly advise me whether the engine in the 1917 Overland six is made by the Continental Motor Co. The model is No. 85-6 and sells for $925.

Franklin, N. J. F. C. H.

—The Willys-Overland Co. will continue to use the Continental engine for its six-cylinder car throughout 1917.

Changing Hudson 33 Into Delivery Car

Editor THE AUTOMOBILE:—I have a 1911 Hudson 33 torpedo body five-passenger car which I wish to change into a commercial body to use for delivery of farm produce. Is there any body made to fit these conditions? The gasoline tank would have to be relocated as it is now under the front seat.

Mansfield, Mass. S. F. F.

—You would have to take this matter up with a carriage builder. There is no stock body made which would suit you. You must be very careful that you do not overload the chassis since the frame, springs and axle are only designed to sustain the weight of five passengers and any dead load which you put on it ought not to be greater than that.

Assuming you convert the body, the useful load it would carry in addition to the driver ought to be limited to 600 lb.

There is no reason why you should not continue to keep the gasoline tank under the driver's seat. Our advice is that you discuss the matter with someone near you who you think could build a body and get his ideas on it. The usual way to get a reasonable platform space is to build wooden cross pieces which will lift the platform about 1 ft. above the top of the wheel. Possibly you could move the driver's seat forward by setting the steering gear more nearly vertical but it is very likely the position of the gear lever and of the pedals will prevent you gaining much in this way. Probably the cheapest plan would be to leave the front seat as it is and substitute a small platform for the tonneau.

Information on Nitrogen Filled Bulbs

Editor THE AUTOMOBILE:—Do nitrogen-filled bulbs give more light than regular vacuum type with the same amount of feed from battery?

2—What would be proper candlepower nitrogen bulbs to substitute for regular vacuum type 15 cp. bulbs in headlight, would it be 21 cp.?

3—What would be the approximate added burden to 6-volt battery regularly using 15 cp. vacuum type headlights to substitute 36 cp. nitrogen bulbs, the regular vacuum type consuming 2½ amp. and the 36 cp. nitrogen bulbs consuming 4 amp.?

4—Using regular vacuum type 15 cp. bulbs of 2 amp. generator shows battery charge at about 15 m.p.h. when headlights are turned on. At about what speed would battery charge using 36 cp. nitrogen bulbs of 4 amp.?

5—Does a 21 cp. nitrogen bulb, actually give 6 more candlepower than a 15 cp. regular vacuum bulb when each bulb uses 2½ amp.?

Peebles, Ohio. A. C. P.

—Yes.

2—Yes.

3—The addition would be the difference between the current drawn by the small bulb and that needed for the large one.

4—It is not possible to answer this without knowing the exact characteristic curve for the generator.

5—It ought to do so.

Fitting Route Indicator to Speedometer

Editor THE AUTOMOBILE:—I am interested in connecting a route indicator to the Warner speedometer with which my 1916 Cadillac eight is equipped, and I am at a loss how to determine the exact speed of the shaft at the point where it it connects with the speedometer.

2—The closest I can come to it is 690 r.p.m. I am advised by the Stewart people that the speed of the shaft on their old model speedometer was 2523 r.p.m., and on their 1912 model was 1009; but they failed to give me the speed of the later models.

Occoquan, Va. G. A. D.

—The speedometer shaft on your car should turn 680 times in a mile in order to register mileage correctly. It will do this if the car is equipped with standard size tires 36 by 4½ in.

2—When speedometer shaft speeds are given in the revolutions per minute this usually means revolution per minute at some particular number of miles per hour.

Oil Satisfactory in Ford Cups

Editor THE AUTOMOBILE:—Kindly advise me if it is desirable to substitute grease cups for the present oil cups on a Ford car and if they are as satisfactory as concerns lubrication as the oil cups?

2—Where can I secure grease cups for the Ford to replace the oil cups having a large grease capacity? Also cups having a large oil capacity to replace the present system?

3—Is there any power pump that has proven successful on the Ford? What are the merits of the spark plug pumps? I have heard that they are detrimental to the engine.

Hot Springs, Va. R. B. D.

—As long as you keep the oil cups filled lubrication will be just as good as you will get with grease. Many engineers greatly prefer oil to grease, as it flows much more easily in cold weather.

2—You could get greasecups or large oil cups from any good accessory house or your dealer could obtain them for you.

3—Any of several tire pumps will give you satisfaction. The spark plug pumps are very good and cannot possibly damage the engine. If you purchase one of these pumps do not forget that it is most effective when the engine is running slowly. If the engine is speeded up too much the piston in the pump will not draw in a full charge as it does not get time to make its return stroke.

55,000 Wire Wheel Cars in 1916

Editor THE AUTOMOBILE:—Kindly advise the probable number of automobiles equipped with wire wheels during the 1916 season and also the probable number of cars to be equipped with wire wheels in the 1917 season.

Johnstown, Pa. F. H. M.

—At the present time we estimate that about 55,000 new cars have been equipped with wire wheels in 1916 and the manufacturers expect that fully 200,000 will use them in 1917.

Bijur Regulator Wiring Diagram

Editor THE AUTOMOBILE:—Will you kindly give me a wiring diagram of a Bijur regulator, showing how same is connected to a 1913 Packard car generator, replacing the mercury regulator made by the Delco company.

2—Also give a diagram showing the internal circuits of same and any other data you may have explaining its operation.

New York City. B. F. K.

—Fig. 1 shows the connections to a Bijur regulator. Regarding the internal mechanism, this Bijur regulator is a vibrating field voltage controller described on page 741 of THE AUTOMOBILE for Oct. 21, 1915. The diagram of the vibrating type regulator published herewith shows all the essential details of the Bijur instrument.

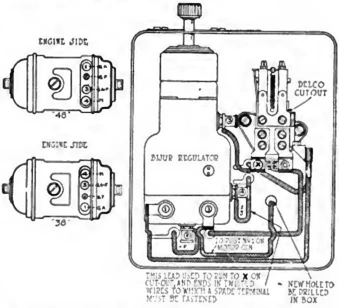

ENGINE SIDE
48
ENGINE SIDE
38
BIJUR REGULATOR
DELCO CUTOUT
TO POST ... ON MOTOR GEN
THIS LEAD USED TO RUN TO X ON CUT-OUT, AND ENDS IN TWISTED WIRES TO WHICH A SPADE TERMINAL MUST BE FASTENED
NEW HOLE TO BE DRILLED IN BOX

Fig. 1—Wiring diagram of a Bijur regulator, showing connections as used on a 1913 Packard generator

ACCESSORIES

Hercules Auxiliary Bearing

THESE bearings are designed to increase the carrying capacity of Ford cars and to prevent the breakage of axle shafts. The bearings remove the weight of the car and load from the axle shafts and permit the use of solid rubber tires or demountable rims by taking care of the extra weight. The manufacturer states that these bearings also eliminate wobbling of the wheels and side sway. A set consists of two combined radial and thrust bearings capable of carrying a load of 3800 lb. at axle speed. These bearings are mounted on the outer ends of the Ford rear axle housing and engage steel brackets to be fitted in the inside of the brake drums. These brackets are secured by six special bolts, replacing the bolts used for fastening the brake drums and hub flanges to the wheels. When the wheels are in place on the axle shafts, these steel brackets engage the outer race of each auxiliary bearing, bringing these bearings only 1¼ in. from the center of the wheel. Thus they carry the load close to and on the wheels. The bearings can be installed by anyone with a wrench, no machine work or change in the Ford wheels or axles being required. —Hercules Auxiliary Bearings Works, 327 S. La Salle Street, Chicago, Ill.

Superior Spot Lamp

Combining the functions of a spot and trouble light this lamp can be moved in any direction desired and throws a direct beam of light far in advance of the car. It has a silver-plated spun brass reflector and the exterior is finished in dark enamel which the manufacturer states will not peel. The lamp is fitted with an adjustable, removable mirror at the back of the clamp so that the driver can see cars coming up behind. The lamp itself is a 6 volt 21 candlepower nitrogen type with double contact, the switch being on the end of the handle. The windshield attachment is of heavy steel with strong bolts to prevent the lamp from sliding. The lamp is 6¼ in. in diameter over all and the length from the switch to the lens is 7⅞ in. A cord 10 ft. in length is supplied with each lamp for use as a trouble detector. — Pittsburgh Lamp, Brass and Glass Co., Pittsburgh, Pa.

M. and M. rim contractor

M. & M. Rim Contractor

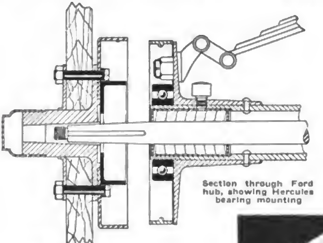
A tool for removing or replacing rims of the Standweld, Baker, Firestone, Detroit or Kelsey type. Clamps connected by a threaded rod are fastened on opposite sides of the rim, and the rim contracted by means of a turnbuckle. Turning the buckle in the opposite direction expands the rim to its original position. Price, $1.—M. & M. Mfg. Co., Bayside, N. Y.

The York Gsa Saver

An auxiliary air valve screwed into the intake manifold. It consists of a metal nipple carrying an adjustable nozzle whereby the amount of additional air entering the manifold may be regulated. The installation requires the drilling of a 11/32 in. hole in the intake manifold just below the spread, tapping it to ⅛ in. std., and screwing in the valve. Price, $3.—York Gas Saver Co., 1518 Jefferson Avenue, East, Detroit, Mich.

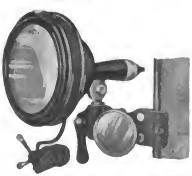
Name-On Robe

The owner's name is interwoven in the edge of the robe. It is made of long fiber mohair and bound with triple-stitched felt. The robe is reversible, having one color on one side and the other color on the reverse. The name is woven so as to show on both sides. The robe is claimed to be durable and warm without being bulky or heavy. Price, 54 by 72 in., $12.50; 54 by 84 in., $15.—J. & E. Dawson, Palethorp and Somerset Streets, Philadelphia, Pa.

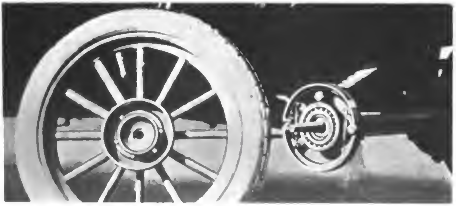


Section through Ford hub, showing Hercules bearing mounting

York Gas Saver which admits additional air intake



Superior spot and trouble light



Ford rear wheel removed, showing Hercules auxiliary bearing in place

Standards Committee Accepts Four S. A. E. Reports

(*Continued from page* 645)

width of the V is to be 3 mm. and its length 2.5 mm., as illustrated.

Location of Filament in Bulb—7—All headlamp bulbs regardless of their diameter are to have the center of the filament located in the axis of the bulb, 1¼ in. from a plane tangent to the nearer sides of the locating pins in the bulb base, as in the sketch.

Location of Receptacle in Headlamp—8—All headlamp receptacles are to be located in the reflectors so that a plane passing through the registering points of the bayonet slots is 1¼ in. from the focal point of the reflector when the receptacle is at the mid-point of its adjustment, as illustrated.

Focal Length of Reflector—9—It is tentatively recommended that all headlamp reflectors be made as near as possible to the outline of a true parabola of 1¼ in. focal length, as in the drawing.

Limits on Location of Filaments—10—Investigation is being carried on in regard to the practicability of locating filaments within limits close enough to avoid the necessity of adjustments for focusing, or at least of focusing in replacing bulbs.

11—At the present time, filaments are located in the glass portion of the bulb by eye, and the glass bulb is afterward cemented into the base, its exact position being dependent upon variation in the size of the bulb.

12—Under these conditions it is said that the total variation is held within limits of 1/16 in. plus or minus. One of the largest manufacturers of bulbs has reported that the cost of bulbs would be increased by from 5 to 10 cents each by changes in manufacturing methods which would hold the center of the filaments within 1/64 in. of the bulb axis and within 1/32 in. (plus or minus) of the standard distance from the pins in the base.

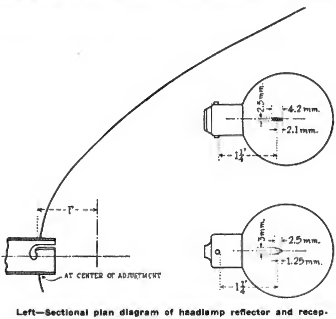
Mounting of Starters, Generators and Ignition Distributers—13—The sub-division on standards for mounting these various electrical units has been doing active work, but is not yet prepared to offer final recommendations. Definite proposals for mounting starting motors and generators have been proposed and criticized. Members of the sub-division are engaged in trying out the proposals on layouts of engines of different make, in order to revise the proposals so as to make them suitable to existing engine designs as far as possible. It is hoped that this work will be completed before the end of the present calendar year.

14—Standard dimensions for ignition distributers have been formulated with the co-operation of interested manufacturers. The dimensions are suitable for mounting the distributer either on the engine or on the generator. The proposal has not yet been submitted to the division.

Storage Battery Subjects—15—A sub-division has been appointed and has done some preliminary work in regard to terminals of storage batteries for gasoline cars. Another subject which this sub-division will consider is dimensions for storage battery compartments.

Among the speakers were A. G. Batchelder, Dr. H. M. Rowe and J. O. Lagorz of the American Automobile Assn. W. E. McKechnie, electrical engineer, Cadillac Motor Car Co., stated that the research of the headlight glare sub-division showed that the problem was very complicated and that no solution could be reached until scientific study revealed certain causes of glare not now known. To this end he proposed that a separate division be created to consist of a few members deeply versed in the subject to co-operate with other engineering bodies in the electrical and illuminating field in collaboratively solving the question. This proposal was enthusiastically received in view of the imminence of much drastic legislation at great variation pending in different states.

The problem first encountered by the sub-division was the variation in filament position on different bulbs which destroyed the focus and caused stray and reflected lights. It is working now to standardize filament position and shape but more research is needed, especially in determining correct focal length for ample illumination without glare and provision for tolerance in filament placing without manual adjustment. Mr. Rowe also supported the suggestion in telling the committee something of the existing legal situation.



Left—Sectional plan diagram of headlamp reflector and receptacle. F is focal length of reflector—1¼ in. Right—Location of filaments in bulbs. Above—Vacuum bulb. Below—Gas filled bulb

Truck Standards

Discussion of military truck standards followed the report of the truck control standards chairman, H. D. Church, Packard Motor Car Co. All the recommendations were approved with the understanding that the standards did not mean to require any segment for spark throttle levers being recognized as advantageous in commercial work and imperative in military application. The report follows:

Truck Control Standards

1—The following recommendations apply to both right and left drive trucks:

Gearshift and Hand Brake Levers—2—It is recommended that the gearshift and hand brake levers be placed at the driver's right, with the hand brake lever to the right of the gearshift lever. The hand brake lever is to be pulled back for brake application. The gearshift lever is to be fitted with a latch guarding the reverse position, or the equivalent of a latch, when used with either a three or four-speed transmission.

Gearshift Lever Handle Positions—3—It is recommended that for three-speed transmissions the positions of the gearshift lever handle be the same as recommended by the miscellaneous division for standardization for pleasure cars. Four-speed transmissions are to have the forward speeds so arranged that the gearshift handle in high speed is in the same position as with the three-speed transmission, low speed occupying the place of reverse. The location of the reverse position is to be left optional. It is further recommended that with either three-speed or four-speed transmissions, the various speeds be clearly indicated, either on the gate or at the base of the gearshift lever.

Clutch and Brake Pedal—4—It is recommended that the clutch pedal be located to the left of and the foot brake pedal to the right of the fore and aft center line of steering column.

Accelerator Pedal—5—It is recommended that the accelerator pedal be placed to the right of the brake pedal.

Spark and Throttle Hand-Levers—6—It is recommended that spark and throttle hand-levers, if used, should be located to the right of the fore and aft center of the steering column. The spark lever should be the shorter of the two and both levers carried on stationary sectors. Both levers should be arranged so that they are pushed forward to advance the spark and to open the throttle.

Military Specifications Mangled

The tentative military truck specifications were literally torn to shreds as to detail, Henry Souther maintaining stand-

(*Continued on page* 681)

Details of Argentine Trade-Mark Law—Part II

(Continued from page 646)

themselves aggrieved by the mark may file opposition, and the applicant's attorney is notified and given an opportunity to reply. If the opposition is based on a previous registry or is not merely capricious, the Office cannot decide the case, and the proceedings are suspended. Applicant may then ask for the case to be sent to the Federal Courts, where the proceedings take the nature of an ordinary lawsuit.

Renewals: At the end of the 10 years period the registration may be renewed for an equal period, and so on indefinitely. The proceedings are exactly the same as in the original application. The term begins as from the date of grant, although the mark is protected as against subsequent applications from the moment when it is filed.

Secret manner of printing: Applicant may keep secret the manner of printing the mark in certain cases. In such cases the process of printing must be fully described and the description filed together with the application, in a sealed envelope, which may only be opened in open court in case of litigation.

Infringement: All infringement cases are tried in the Federal Courts. The penalty (see previous clause on this subject) consists of a fine of $20 to $500 Argentine and arrest from 1 month to 1 year, not redeemable by payment of money. The goods sold under a mark declared by the court to be an infringement are confiscated and sold for the benefit of the school fund. The sentence of the Federal Court may be carried to the Federal Chamber of Appeals and the winner of the suit may then sue the loser for damages in the common courts, if so declared in the sentence.

Administration: The author would be lacking in gratitude for courteous treatment experienced from the entire staff of the Argentine Patent and Trade Mark Office during many years, if he failed to close this article without a word of commendation for them. Above all he desires to state his sincere conviction that this department is carried on in a spirit of fairness and justice, interpreting the law in so far as it lies within its province to do so, in an able and strictly impartial manner. Although it may seem to some applicants that their cases are unduly delayed, this is entirely due to the great increase in the number of applications without the corresponding increase in staff.

There are twenty-five different classifications for copyright consideration, those quoted below apply to the automobile industry:

Class 12.—Machines, apparatus and elements of transport in general, their various parts and their accessories.

Such as: Locomotives, rolling stock for railways and tramways, telpherage systems, rails, semaphores, cranes and winches, movable bridges, endless carriers, lifts or elevators, freight elevators, endless screws, automobiles, aeroplanes, airships, balloons, motorcycles, bicycles, carts and carriages in general, hydroplanes, ships, motor launches, boats, dredges, floating cranes.

Class 17.—Caoutchouc, rubber and guttapercha, wrought and unwrought and in every state of preparation, and all articles made of that substance, except those used in electricity, surgery or orthopædia.

Such as: Transmission belts, air chambers and covers for vehicle tires, balls and toys, tubes, plate, cord, etc.

Class 19.—Leather furs and skins, wrought and unwrought, not included in other classes. Saddlery and harness, trunks, and traveling goods generally.

Such as: Fur garments, harnesses, trappings, horse furnishings, whips, blankets for animals, buckles, stirrups, bits, spurs, reins, trunks and valises in general, straps, portmanteaux, walking stick cases, hat cases.

Class 20.—Electricity, electrical machinery, supplies, apparatus and accessories for the production of power, heat and light, telephony, telegraphy and wireless telegraphy.

Such as: Dynamos, alternators, resistances, magnetos, telegraphic, telephonic and radiographic apparatus, electric lamps in general; sockets, tulips and globes, motors, commutators, wire and cable for electrical use, transformers, carbons for electric lamps, insulators, voltmeters, ammeters and other measuring and experimental apparatus; insulating fabrics, accumulators, batteries and cells.

Class 14.—Apparatus and articles for heating; ventilation, illumination, refrigeration, hydrotherapy, sanitary articles, machines, apparatus and supplies for cleaning, in general, washing, soaking and cleaning clothes.

Such as: Ranges, braziers, heating devices, stoves, central heating boilers, radiators, thermo-syphons, still worms, ventilators, aspirators, air injectors, gas generators, lamps of all kinds, lighting devices, luminous buoys, chandeliers, lanterns (of all kinds), freezing machines, machines for making ice and ice creams, refrigerators, shower bath apparatus, douches, baths of all kinds, bath-tubs, lavatories, water-closets, bidets, syphons, traps and other sanitary articles, machines, apparatus and articles for washing, wringing, ironing, and drying; carpet, curtain and tapestry cleaners, vacuum cleaners, brooms, feather dusters, brushes, mops, polishing cloths and skins; metal, wood, clothes, and leather cleaning soaps, pomades, powders and liquids; starch, borax, soda, bluing, preparations for polishing and waxing floors, stain erasers, etc.

Class 15.—Fabrics and textures in general; knitted fabrics; table linen, and linens in general.

Such as: Wool, silk, linen, cotton, jute and other vegetable fiber cloths and fabrics, waterproof or not; mixtures of the same; knitted goods, stockings, undershirts, underwear made of these fabrics; table cloths and napkins, sheets, pillow cases, quilts and blankets.

Class 10.—Hardware, cutlery, paints and colors, locksmithery, ironmongery, builders' hardware, house furnishing, bazaar articles and tinmongery; non-electric cable, canvas goods; picture frames and moldings; basketware, etc.

Such as: Tools in general with or without edge or point, not otherwise classified; razors and safety razors; cutlasses; knives, forks and spoons; daggers, colors and paints; varnishes, sealing wax, lacquers, wall paper, brushes, oil and turpentine for paints, rope, twine, and cord of hair or fiber, locks, bolts, hinges, chains, anchors, articles of ironmongery, of tin, brass, and the like; kitchen utensils, iron glazed and enamel ware, nails and screws, tents, flags, canvas awnings, sails, bags of any kind of cloth for any purposes; insulating cloths and papers; damp-proof materials; bottle caps, corks and metallic stoppers, fire kindlers, night tapers, baskets and similar objects in general; chains of all kinds, transmission belts in general; except those of caoutchouc or rubber.

Class 5.—Machines and apparatus of every kind of industry not otherwise classified, parts of the same; accessories and implements for dyeing or filtering. Machines, apparatus and implements of agriculture, aviculture, apiculture, fish culture, dairy, grape, wine culture, forestry, and cooperage.

Such as: Pumps, generators for motors, machines driven by water, gas, naphtha, steam and the like, machine ing machines and needles for same; fire tools, boilers not otherwise classified; motors, sewing, knitting and embroider-extinguishing engines, pumps and apparatus, etc.

(To Be Continued.)

Doehler Moves Brass Dept.

BROOKLYN, N. Y., Oct. 16—The Doehler Die Casting Co. has removed its brass-back bearing department from Brooklyn to its new Toledo, Ohio, plant.

Accessory Spaces Allotted to 87 Concerns

(*Continued from page* 642)

Goods Co.; Lumen Bearing Co.; Parry Mfg. Co.; Wagner-Hoyt Electric Co.; West Side Foundry Co.; Rubber Insulated Metals Corp.; and the Syracuse Malleable Iron Works.

The list of exhibitors follows:

NEW YORK AND CHICAGO

A. B. C. Starter Co............Detroit, Mich.
American Bronze Co.............Berwyn, Pa.
American Hardware Corp. (Corbin Screw Corp. Division) ....New Britain, Conn.
Au-To Compressor Co......Wilmington, Ohio
Automobile Supply Mfg. Co..Brooklyn, N. Y.
Benford Mfg. Co...........Mt. Vernon, N. Y.
Brown-Lipe Chapin Co........Syracuse, N. Y.
Brown-Lipe Gear Co.........Syracuse, N. Y.
Brunner Mfg. Co..................Utica, N. Y.
Buda Co..............................Harvey, Ill.
Byrne-Kingston & Co..........Kokomo, Ind.
Carr Co., F. S....................Boston, Mass.
Celfor Tool Co..............Buchanan, Mich.
Champion Ignition Co.............Flint, Mich.
Corning Glass Works..........Corning, N. Y.
Cowles & Co., C...........New Haven, Conn.
Corcoran-Victor Co..........Cincinnati, Ohio
Cramp & Sons Ship & Engine Building Co., Wm...................Philadelphia, Pa.
Dann Products Co................Chicago, Ill.
Detroit Weatherproof Body Co...........
Dixon Crucible Co., Joseph..Jersey City, N. J.
Doehler Die Casting Co.......Brooklyn, N. Y.
Dyneto Electric Co............Syracuse, N. Y.
E. A. Laboratories Co., Inc...Brooklyn, N. Y.
Eclipse Machine Co...............Elmira, N. Y.
Electric Storage Battery Co., Philadelphia, Pa.
Evapco Mfg. Co...................Detroit, Mich.
Ferro Machine & Fdry. Co...Cleveland, Ohio
Findeissen & Kropf Mfg. Co.....Chicago, Ill.
Gabriel Mfg. Co.................Cleveland, Ohio
Gemco Mfg. Co................Milwaukee, Wis.
General Electric Co.......Schenectady, N. Y.
Globe Machine & Stamp. Co..Cleveland, Ohio
Gould Storage Battery Co....New York City
Gray & Davis......................Boston, Mass.
Halladay Co., L. P...............Streator, Ill.
Hall-Thompson Co...........Hartford, Conn.
Hartford, Inc., Edward V..Jersey City, N. J.
Hassler, Robert H..........Indianapolis, Ind.
Hayes Mfg. Co..................Detroit, Mich.
Hayes Wheel Co...............Jackson, Mich.
Heinze Co., John O..........Springfield, Ohio
Heinze Electric Co..................Lowell, Mass.
Kellogg Mfg. Co..............Rochester, N. Y.
Kent Mfg. Wks., Atwater...Philadelphia, Pa.
Klaxon Co. ....Newark, N. J.
Kokomo Electric Co.............Kokomo, Ind.
Leather Tire Goods Co..Niagara Falls, N. Y.
Leece-Neville Co. ....Cleveland, Ohio
Lipman Air Appliance Co........Beloit, Wis.
Lumen Bearing Co..............Buffalo, N. Y.
Mann Co., F. W..................Milford, Mass.
Master Carbureter Corp.........Detroit, Mich.
Mosler & Co., A. R........Mt. Vernon, N. Y.
Motometer Co........Long Island City, N. Y.
New York Coil Co............New York City
North East Electric Co......Rochester, N. Y.
Otis Elevator Co.............New York, N. Y.
Pantasote Co. ....New York, N. Y.
Parry Mfg. Co..............Indianapolis, Ind.
Perfection Spring Co..........Cleveland, Ohio
Piel Co., The G......Long Island City, N. Y.
Pest-O-Lite Co.............Indianapolis, Ind.
Royal Equipment Co.......Bridgeport, Conn.
Sager Co., J. H..............Rochester, N. Y.
Schrader's Son, Inc., A........Brooklyn, N. Y.
Shakespeare Co.............Kalamazoo, Mich.
Shaler Co., C. A..................Waupin, Wis.
Sparks-Withington Co..........Jackson, Mich
Splitdorf Electrical Co.........Newark, N. J.
Springfield Body Co.........Springfield, Mass.
Standard Thermometer Co.....Boston, Mass.
Standard Welding Co........Cleveland, Ohio
Stewart Warner Speedometer Corp., Chicago, Ill.
Stromberg Motor Devices Co....Chicago, Ill.
U. S. Light & Heat Corp., Niagara Falls, N. Y.
Universal Shock Eliminator, Inc...New York
Vacuum Oil Co..............New York, N. Y.
Van Sicklen Co.......................Elgin, Ill.
Veeder Mfg. Co..............Hartford, Conn.
Voorhees Rubber Mfg. Co..Jersey City, N. J.
Wagner-Hoyt Electric Co...New York, N. Y.
Waltham Watch Co.........Waltham, Mass.
Westinghouse Elec. & Mfg. Co. Pittsburgh, Pa.
West Side Fdry. Co..................Troy, N. Y.
Wheeler-Schebler Carbureter Co., Inc., Indianapolis, Ind.
Willard Storage Battery Co...Cleveland, Ohio

NEW YORK ONLY

Blackledge Mfg. Co., J. W.......Chicago, Ill.
Bosch Magneto Co...........New York, N. Y.
Breeze Carbureter Co..........Newark, N. J.
Budd Mfg. Co., Edward G..Philadelphia, Pa.
English & Mersick Co.....New Haven, Conn.
General Bakelite Co.........New York, N. Y.
Hale & Kilburn Co..........Philadelphia, Pa.
Hartford Machine Screw Co..Hartford, Conn.
Herz & Co....................New York, N. Y.
Janney-Steinmetz & Co....Philadelphia, Pa.
Light Mfg. & Fdry. Co........Pottstown, Pa.
Morse Chain Co.......................Ithaca, N. Y.
Rubber Insulated Metals Corp., Plainfield, N. J.
Syracuse Malleable Iron Wks., Syracuse, N. Y.
Ward Leonard Elec. Co....Mt. Vernon, N. Y.
Zenith Carbureter Co..........Detroit, Mich.

CHICAGO ONLY

Badger Brass Mfg. Co.........Kenosha, Wis.
Continental Motors Co.........Detroit, Mich.
Edison Storage Battery Co......Orange, N. J.
Garford Mfg. Co....................Elyria, Ohio
Imperial Brass Mfg. Co..........Chicago, Ill.
Oakes Co....................Indianapolis, Ind.
Remy Electric Co.............Anderson, Ind.
Simms Magneto Co........East Orange, N. J.
Vesta Accumulator Co...........Chicago, Ill.
Warner Gear Co..................Muncie, Ind.
Waukesha Motor Co.........Waukesha, Wis.
Wilson & Co.......................Chicago, Ill.

The complete list of exhibitors last year showed 306 accessory exhibitors at New York and 186 at Chicago.

Stiger Elected President

C. W. Stiger of the Stromberg Motor Devices Co., was yesterday, appointed president of the Motor and Accessory Manufacturers, succeeding F. Hallett Lovell, who resigned. L. M. Bradley, prominent in the affairs of the N. A. A. M., and since connected with the automobile and accessory fields, has become manager of the association, succeeding W. M. Sweet, who has resigned to become the assistant to the president of the United Motors Corp. Mr. Sweet was yesterday elected a member of the board of directors to succeed Mr. Lovell and will serve until 1919. Mr. Sweet was also elected chairman of the 1917 banquet committee. Christian Girl of the Perfection Spring Co., was elected as a member of the board to succeed C. E. Whitney, resigned, His term will expire in 1919.

The association also voted to become a member of the Chamber of Commerce of the United States of America.

The following new members were admitted:

A-B-C Starter Co., Detroit, Mich., manufacturer of auto electric starting and lighting systems.

Celfor Tool Co., Buchanan, Mich., manufacturer of internal gear drive motor truck axles and high-speed drills.

Corning Glass Works, Corning, N. Y., manufacturer of technical glassware.

Detroit Weaterproof Body Co., Detroit, Mich., manufacturer of detachable closed tops.

Evapco Mfg. Co., Detroit, Mich., manufacturer of Evapco Gas Savers and Jiffy Starters.

Gillette Motors Co., Mishawaka, Ind., manufacturer of motors, manifolds, piston rings.

The Hall-Thompson Co., Hartford, Conn., manufacturer of polishes, dressings, enamels, chemical compounds.

Lipman Air Appliance Co., Beloit, Wis., manufacturer of air pumps, water and oil calculating pumps and other parts.

Morse Chain Co., Ithaca, N. Y., manufacturer of silent chain and sprocket wheels.

New York Coil Co., 338 Pearl Street, New York City, manufacturer of ignition devices, auto accessories.

Perlman Rim Corp., 1790 Broadway, New York, manufacturer of demountable automobile rims and parts.

Rubber Insulated Metals Corp., Plainfield, N. J., manufacturer of tires, tubes and insulated tools.

Universal Shock Eliminator, Inc., 8 West Sixty-second Street, New York City, manufacturer of shock eliminators, safety buffers.

Wagner-Hoyt Electric Co., 1902 Broadway, New York City, manufacturer of starting, lighting, ignition batteries and switches.

Lyons Fair Despite War

NEW YORK CITY, Oct. 12—American manufacturers will have an opportunity of exhibiting their wares in southern France at the annual fair at Lyons which will be held, despite the war, on March 1 to 15, 1917. The State Department has placed $500 at the disposal of the American consul which will enable him to distribute the catalogs, etc.

Catalogs may be forwarded directly to the U. S. Consul at Lyons, and should be printed in French.

Demountable Top for Buick

NEW YORK CITY, Oct. 17—The Buick Motor Co. is equipping its touring cars with an all-weather top which is demountable. This body will be standard equipment and will cost $212 extra in this city.

All-Weather Top for Chevrolet

NEW YORK CITY, Oct. 17—The Chevrolet Motor Co. is supplying as standard equipment an all-weather top which is removable. This top, which is made by the Detroit Weather Proof Body Co., will cost $70 extra.

S. A. E. Reports Accepted

(*Continued from page* 679)

ards should be mainly confined to results, not means, except in cases where conclusive and recognized data are at hand. K. W. Zimmerschied, General Motors Corp., on the contrary, urged that uniformity of war trucks was of greater importance than what construction is best. F. A. Whitten, General Motors Truck Co., held out for more detailed specifications on the plea that safety demands the use of that which is known to be good, regardless of possible merit of unrecognized designs. Mr. Souther suggested a tread to fit railroads, since many will run on rails. Written discussions by John Younger, Pierce-Arrow Motor Car Co., and C. H. Taylor, Republic Motor Truck Co., disagreed with the detail requirements.

All agreed subject too big for hasty action. A. L. Riker said single paragraphs should be whole papers for discussion.

Engine and Transmission

Chairman W. T. Fishleigh of the engine and transmission division, reported progress on valve-timing data with characteristic curves, standards for poppet valves, starting cranks and belts for fans. Engine support arms and fans were delegated to sub-committees, but the division submitted engine test forms for action. Detail changes suggested and extension to cover aero and tractor engines were agreed upon for final submission in January. R. McA. Lloyd, consulting engineer, urged quick action, as standard engine test forms are greatly needed.

Industrial Miscellany

Factory

Stearn's Wear Proof Tire Co., Canada, with W. H. Matthews as president and offices in Toronto, Ont., has secured the Canadian manufacturing rights for the Stearns wear proof inner tubes.

Falls Motors Corp., Sheboygan Falls, Wis., office and shop executives, has organized an association for the promotion of business and industrial efficiency and social welfare.

Ladish-Obenberger Drop Forge Co., Milwaukee, has arranged for considerable extensions of its plant in Cudahy, Milwaukee county. Ground has been broken for a one-story steel and brick addition, 50 by 200 ft. The plant has been operated on a 24-hr. basis for many months.

Waukesha Motor Co., Waukesha, Wis., will award contracts for the erection of its new administration building, which will embody quarters for the engineering department and draughting rooms. The building is to be of brick and steel, 44 by 88 ft., two stories and basement, and cost $25,000.

Geo. P. Meyers Machine Co., Sheboygan, Wis., manufacturing Wisconsin motor trucks, is building its first 5-in. model.

Paige-Detroit Motor Car Co., Detroit, has received an order from the Bigelow-Willey Co. of Philadelphia for $129,000 worth of enclosed cars. This is one of the largest orders for enclosed cars that the company has received.

Federal Rubber Mfg. Co., Cudahy, has started work on the new six-story manufacturing building. It will be 100 x 157 ft. in size and cost $200,000. It is one of the principal units of the $1,000,000 improvement scheme undertaken some time ago, after the Fisk interests bought the controlling interest from the Milwaukee stockholders.

Savage Tire Co., San Diego, Cal., will add a warehouse of brick and steel construction, adjoining its present building.

Minnesota Tire & Rubber Co. will be formed with a capital stock of $200,000 by H. L. Werner, Red Wing, Minn; H. A. Trenholm, Minneapolis, and J. W. Adams, Ellsworth, Wis. Headquarters will be at St. Paul, Minn. The plant location has not been decided on.

Sterling Automobile Mfg. Co. is rushing its plant at Amston, Conn. The company now occupies a plant in Paterson, N. J.

Partridge Rubber Co., Montreal, Ont., will take over the plant of the Standard Tire & Rubber Co., Guelph, Ont.

Star Motor Car Co., Cincinnati, Ohio, has been formed with $200,000 capital and will establish a plant for assembling steam-driven automobiles. R. M. Wallingford, 1003 Race Street, is secretary.

Keystone Tire & Rubber Co., Pittsburgh, Pa., will build a new plant at Penn Station along the Pennsylvania railroad. The plant will consist of a factory building, three stories, 60 by 190 ft., and of brick and steel construction.

Commercial Automobile Co., Lexington, Ky., will equip a plant for assembling automobile running gears and bodies and for the manufacturing of bodies, etc. The equipment will cost $8,000.

Twin City Four Wheel Motor Drive Co., St. Paul, Minn., is building an addition to cost $30,000.

Mohawk Rubber Co., Akron, Ohio, is gradually finishing its $100,000 addition. The new addition consists of a three-story annex to the building recently completed and an additional story on an old building.

F. L. Jacob Co., Detroit, Mich., will build a one-story factory for the manufacture of automobile parts at a cost of $30,000.

E. H. Orersmith, Jonesville, Mich., who is building motor trucks of the front-drive type on a small scale, is negotiating with the business men's association of Waukesha, Wis., with a view to establishing a plant at that point.

American Brass Co., Kenosha, Wis., has awarded contracts for the erection of a new office building, 48 by 100 ft., three stories and basement, and a private garage and service shop, 30 by 120 ft., one story high. Both structures will be of fireproof construction equipped with sprinkler systems.

Personals

N. A. Young has been made sales manager of the Angsten-Koch Co., Chicago. He was formerly assistant sales manager of the Metal Specialties Mfg. Co.

R. V. Lull has been made sales promotion manager of the King Motor Car Co., Detroit. He was formerly in the sales department.

H. A. Harris, formerly of the Hudson agency at Portland, Me., has been appointed manager of the Oldsmobile branch there.

P. W. Runyan has been put in direct charge of publicity by the Westcott Motor Car Co., Springfield, Ohio. He was formerly assistant to sales and advertising manager of the Robbins & Myers Co., Springfield.

The Automobile Calendar

ASSOCIATIONS

Oct. 25-26—Columbus, Ohio, Automobile Trade Assn., second annual meeting, Virginia Hotel.

Oct. 26—Philadelphia, Pa., Section meeting of Society of Automobile Engineers. Paper by Herbert Chase.

Dec. 2-9—Electricians' Country-wide Celebration.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore. Special performance Ziegfeld's Midnight Follies.

CONTESTS

Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour

Oct. 28—New York Speedway Race, championship.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race, Arizona State Fair.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23 — Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14 — Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15 — Providence, R. I., Speedway Race, Championship.
Race, Championship.

Sept. 29—New York, Speedway

Oct. 6—Kansas City Speedway Race

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Oct. 14 - 21 — Dallas, Texas, Show, State Fair.

Oct. 14-21 — Pittsburgh, Pa., Thirteenth Annual Show, Motor Square Garden, Automobile Dealers' Assn. of Pittsburgh.

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers Assn.

Dec. 2-9 — Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9 - 10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 6 - 10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17 — Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade Assn.

TRACTOR

Oct 14-29—Dallas, Tex., Demonstration, Texas State Fair.

Take Out That Knock

with

JOHNSON'S CARBON REMOVER

THAT knocking in your engine and the difficulty you have climbing hills is due to just one thing—carbon in your cylinders. Why pay from $3.00 to $5.00 for having the carbon burned out when you can quickly do it yourself for 50c—without laying up your machine—without even soiling your hands?

Saves Gasoline

Clean cylinders reduce the consumption of gas from 12% to 25% and give you the maximum power and speed from the minimum amount of fuel. Johnson's Carbon Remover really costs you nothing because the economy in fuel effected by its use will more than make up the price of the carbon remover.

Gives Your Engine More ' Pep''

Do you remember how your engine ran the first 500 miles—quietly and full of pep? You can easily keep it always in that condition. Free-from-carbon cylinders are the secret. An application of Johnson's Carbon Remover every 1000 miles will keep your engine always at its highest efficiency.

Unconditionally Guaranteed

We guarantee Johnson's Carbon Remover without equivocation. No matter how much you use or how you use it, Johnson's Carbon Remover cannot injure any part of your motor. You could soak your engine in it for days without the slightest injury.

If your dealer cannot supply you, send us $1.00 (bill or stamps), and we will send you enough Johnson's Guaranteed Carbon Remover to thoroughly clean an ordinary four-cylinder motor three times.

S. C. JOHNSON & SON RACINE, WIS.

Winter drivers should anticipate cold-weather "balkiness" by installing

RAYFIELD
CARBURETORS

Your Rayfield starts when you're ready.

If you have driven much in winter, you know what carburetor trouble to look for. The Rayfield is the Rayfield—in winter as in summer—it will give you more miles per gallon—more power with low-test gasoline.

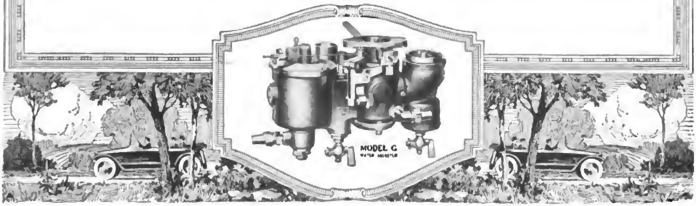
The All-Season Carburetor

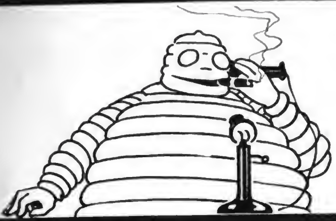
Your money back in 30 days if it doesn't satisfy you in every respect.

If you don't know of a nearby Rayfield Service Station, write to us direct.

Findeisen & Kropf Mfg. Company
2117 Rockwell Street, Chicago

BRANCHES:
1140 Michigan Avenue
CHICAGO
1902 Broadway
NEW YORK
1191 Woodward Avenue
DETROIT





Does it Sound Too Good to Be True?

MICHELIN

Michelin Universal Tread

Casings and Red Inner Tubes

Inch Sizes	Q.D. Str'g't Side	Q. D. Clincher	Red Inner Tubes
32 x 3½	$18.30	—	$3.55
34	19.30	—	3.85
32 x 4	24.90	$24.90	4.65
33	25.65	25.65	4.25
34	25.95	25.95	5.00
35	—	26.50	4.60
36	27.95	27.95	5.30
34 x 4½	33.00	33.00	6.55
35	34.75	34.75	5.90
36	35.70	35.70	6.90
37	—	36.60	6.30
35 x 5	40.50	40.50	6.55
36	—	41.40	8.25
37	41.90	41.90	8.35

Also made in soft bead clincher, size 31x4, Price $22.25. Prices subject to change without notice.

IF you, Mr. Tire Dealer, could sell tires of higher quality than any your competitors offer, and yet could sell these superior tires at lower prices than any other make whatsoever—that would be an ideal proposition.

"But, impossible!" you will say; and quite right. But there is a tire that comes mighty close to ideal.

This tire is absolutely unsurpassed in quality, yet it sells at prices almost as low as the cheapest makes.

And, more than that; it is an advertised tire—advertised in a big way, for the dealer's benefit both nationally and locally.

Highest Quality—Low Price—and Big Advertising!

It may seem too good to be true—But it is true, absolutely true.

And more than that, not only are we doing big advertising regularly to give wider publicity to the name of Michelin, but in addition to that we are doing big local advertising to drive your local customers squarely into your store.

In fact the Michelin proposition for 1917 is the very last step in co-operation between factory and dealer and it covers not only increasing your sales of Michelin products, but the increasing of your entire business.

It's about the most attractive proposition that was ever presented to a dealer and if you have not yet taken interest enough in this proposition to get in touch with us you are standing in your own light.

Write or wire today. You should know all about this at once.

MICHELIN

NOT only is our national advertising giving wide publicity to the new Michelin Universal Tread which has been brought out after three years of laboratory and road experiments, as well as to the generally accepted leader of all tubes, the Michelin red inner tube—

But in addition to the publicity given these two established commodities we are also making a hard drive on the various Michelin accessories, the sale of which means more dollars and cents to Michelin dealers.

Included in this list of accessories is Michelin Mastic, a plastic cement, not a liquid, that is used for filling cuts in envelopes and repairing punctures in inner tubes. It is not simply an adhesive but a plastic compound or filler which replaces torn rubber, practically renewing the injured part, and makes repairs which are not possible with fluid. Instructions for use in every can.

Michelin Pure Red Para Patches for repairing all makes of inner tubes. These patches come in four sizes.

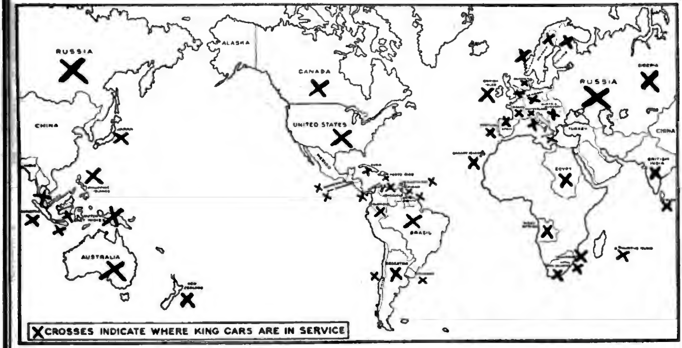
Michelin Cement is the strongest cement it is possible to make, put up in quantities to suit the individual requirements of the purchaser. One and two ounce tubes, one-fourth-pint, pints and gallon cans.

Michelin Mastic and Cement combination. Includes standard size 2-ounce cans of Mastic and Cement. Put up in a handy lithographed carton. Forms a convenient package for the auto owner, and an interesting counter display.

All Michelin accessories have been a standard of quality for many years and the additional impetus we are giving to their sales through our advertising this year will make them fast moving specialties which should be carried in quantities by every dealer.

MICHELIN TIRE COMPANY

Milltown, New Jersey



The world-wide success of the KING car at the beginning of its 3d year of 8-Cylinder leadership

IN October, 1914, after several years of building successful "Fours," the King Motor Car Company announced the world's *first* popular-priced eight cylinder automobile—and the second American car of that engine type. Today there are *more* eight cylinder Kings in operation the world over than any other "Eight" save one.

Throughout America, and in forty-nine foreign lands, in every climate and over all kinds of roads, this *pioneer* "Eight" is giving the satisfaction that makes every owner a King salesman. The King Company has never had a "war order," yet in England alone there are 270 Kings in private service—and American automobiles have been barred from that market since March of this year.

1916 has been a year of many triumphs for the KING Eight, all made with *stock cars*. 10,850 miles without stopping the motor was the great OFFICIAL A. A. A. record. 987 miles sealed in high gear, and the climbing of tortuous Mt. Wilson in the same manner, are two Pacific Coast feats, and 544 miles sealed in "high" is a New York exploit. An OFFICIAL A. A. A. economy test, from Pittsburgh to Milwaukee, under actual touring conditions brought further honors to the King.

The KING Eight will be continued for 1917 substantially as now constructed. This Company does not wait for "popular" announcement seasons to make refinements and improvements—these go steadily on during the entire year.

KING
8 Eight 8

7 Passenger 60 Horse Power

Touring Car	**$1350**
Roadster	**$1350**
Sedan	**$1900**

Prices F. O. B. Detroit

KING MOTOR CAR COMPANY Detroit

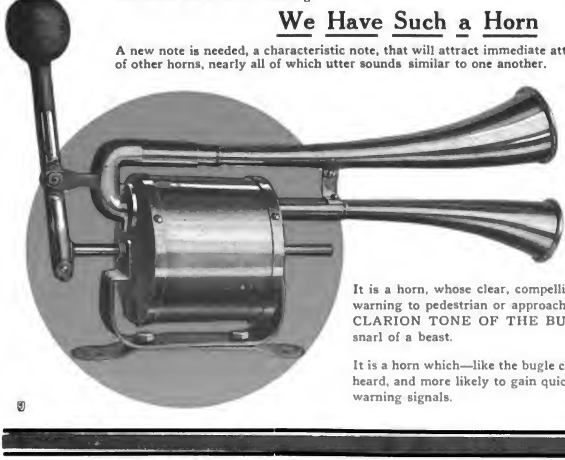
$25 FOR

(Read this carefully—then send u
compelling and easily remembere
for a horn of UNIQUE construc
ing note: If the name you send
the opinion of the judges we will
or more persons send in the winn
EACH OF THEM.)

Few things are more urgently needed in motordom than a distinctive horn—a horn that will give an effectual warning without offending the sensibilities and shaking the nerves of all within hearing.

We Have Such a Horn

A new note is needed, a characteristic note, that will attract immediate attention amidst the roar of other horns, nearly all of which utter sounds similar to one another.



The
(————)
HORN
Supplies
This Note

It is a horn, whose clear, compelling call carries instant warning to pedestrian or approaching car—but with the CLARION TONE OF THE BUGLE rather than the snarl of a beast.

It is a horn which—like the bugle call—is clearer, farther-heard, and more likely to gain quick attention than other warning signals.

A NAME

an appropriate descriptive name,
for this HORN—a different name
ion, operation and individual warn-
in is the best name submitted, in
pay you $25.00 in gold. In case two
ng name, $25.00 will be paid to

It is a horn that will clear the way without danger of exciting **panicky nerves to complicate the Driver's task—it conveys a warning; not an ominous threat or insulting challenge.**

It is a horn easily manipulated by a lever, giving a single or double, loud or soft, long or short, or a succession of quick sharp blasts, as occasion may require. It is simple, durable, reliable.

We Want a Name That Will Embody and Express These Qualities

A Descriptive Name

A name that will herald the introduction of a NEW SIGNAL into Motordom—a clear note, a note that suggests progress and SAFETY—not HARSHNESS, DISCOURTESY, MISUNDERSTANDING and ACCIDENTS.

A name that will instantly suggest the horn itself—the embodiment of all that a simple, effective, law-abiding, DECENCY-COMPELLING automobile warning signal should be.

The men back of this horn have had long experience in the manufacture and merchandising of automobile accessories.

Samples of the new horn are now ready and deliveries will be made on or about January 1st, 1917. As soon as the Committee decides on the name, a strong national advertising campaign will be inaugurated.

Description

Operation is accomplished by moving the hand lever backward or forward or both, if prolonged signal is desired length and volume of signal can be easily controlled giving a range of sound from a succession of short sharp blasts produced by tapping the knob or lever handle, to a prolonged continuous signal secured by moving this lever forward and backward as long as desired.

A different HORN—different in TONE—different and positive in OPERATION.

Manufactured in all black, or black and nickel with adjustable universal bracket.

The (————) Horn will be an ornament to any car.

A better Horn—a better price, a better proposition for dealers and jobbers.

This advertisement will not appear again. Send in one or more names TODAY! Contest closes November 1st, 1916.

Address "Horn Contest Committee"
The Class Journal Company, 239 West 39th Street, New York City

C A

Look to the Future—Stay in the Motor Car Business with Case

A Year of Surpassing Success—A Car of Surpassing Popularity

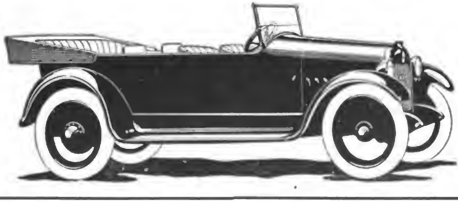
Case manufacturing principles have followed, since 1842, the uncompromising standards founded by Jerome I. Case.

Our greatest triumph—the Case 40—is the highest expression of Case ideals. It embodies the utmost in Case mechanical achievements, and we have crowned it with beauty and luxury equaled only by cars of the costliest class.

In this great Case 40 you can give buyers every desirable feature the motor car industry has. You can give them extraordinary power. You can give them economy in fuel and tires. You can give them a long, roomy body. You can give them exceptional beauty. You can give them simplicity and freedom from trouble. You can give them durability and dependability that no other car can excel.

And you can give them all these things at a remarkable price—$1190.

Consider also what it means to sell a car mechanically perfect. Our dealers testify that the Case takes less attention than any other car they ever sold.



S E

Write Us to Tell You What We Have in Store for New Dealers

To the Wide-Awake Dealer

Where We Are Not Now Represented

This company now has many dealers in the United States and Canada, but we are constantly adding to this great roster of business-getters. For the current season we have much in store for Case dealers.

And due to an increase of 50 per cent in our factory output we are able to make prompt deliveries of cars.

In an organization of this size and scope it is natural that vacancies exist and changes are occurring from time to time. In a few localities we have no local dealer.

If this is the situation where you are located you will do well to communicate with us promptly.

You will, we promise, find our proposition exceptional. If you fail to write you will miss an unusual opportunity. Investigation costs you nothing. Write us today—you'll be well repaid.

J. I. CASE T. M. COMPANY, Inc., 101 Liberty St., Racine, Wis.
FOUNDED 1842

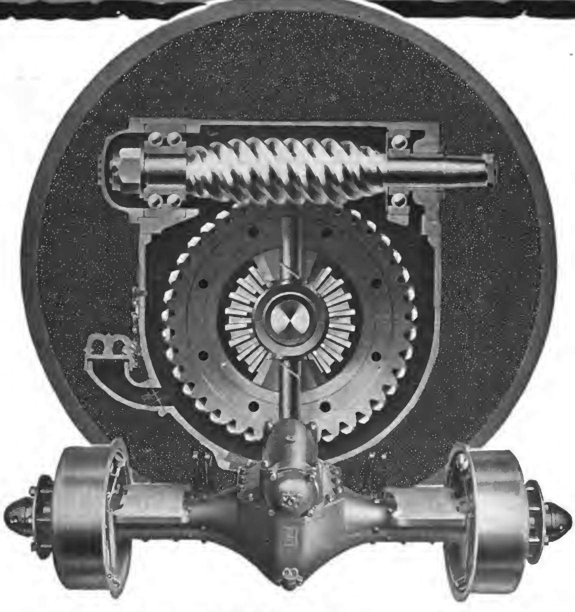
CASE
The Sign of
Mechanical
Excellence
the World Over

44 Branches throughout the United States and Canada

where cars are carried in stock and through which we provide service to dealers unsurpassed, if indeed equaled, by the service of any other motor car manufacturer in the world.

CASE
The Sign of
Mechanical
Excellence
the World Over

Use Worm D



Lowest operating cost combined with longest life.

This briefly explains the dominancy of the worm gear as a type of final drive. It explains why the long list of prominent truck builders we have been showing for some weeks past are adherents to the worm gear.

This condition is due largely to that peculiar characteristic of the worm drive which provides that the longer a worm gear is used, up to the point of final destruction, the better the worm gear performs.

9

rive Trucks

And also to the further fact that the life of a worm gear is exceptionally great—much greater than any other type of drive by long odds, and much more efficient throughout its entire life.

Sheldon was the pioneer worm gear axle specialist in this country. Abroad, worm gear as a type has been accepted for years and years—until today any other type must be offered with an apology and an explanation.

Profiting by the years of experience of the foreign truck builders, Sheldon designers began about five years ago on the production of the present day Sheldon Worm Gear

SHELDON

Driven Axle—an axle that beyond question is the most efficient type of final drive that has ever been produced—an axle that in many respects surpasses the very best of the foreign product.

Sheldon Axles occupy this position of supremacy, first, because they are worm gear driven. (Any properly made worm gear driven axle is superior to any other type—as overwhelming evidence shows.)

And then—because Sheldon has gone a step further and incorporated with its superior fundamental principle other features of design and construction which have added to the high efficiency of the worm and wheel. These features in the main are as follows:

SEMI-FLOATING CONSTRUCTION—Because of the simplicity, sturdiness and consequent durability inherent in the semi-floating method of construction Sheldon Worm Gear Driven Rear Axles are of the semi-floating type.

BALL BEARING WORM MOUNTINGS—Because of the higher efficiency of ball bearings and their particular adaptation to the demands of the worm gear both radial and thrust loads in Sheldon Worm Gears are carried on ball-bearings.

DRIVE THROUGH REAR SPRINGS—As an added feature of simplicity and to eliminate radius rods and torsion tubes with their attendant weight and complications Sheldon Worm Gear driving strains are taken through the rear springs.

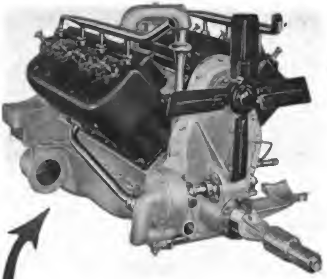
BRAKES ON REAR WHEELS—Both Sheldon brakes are on the rear wheels. This relieves the bearings, the differentials and all the parts back of the transmission of about two-thirds of the strains imposed upon these parts by the use of a propeller shaft brake.

The Sheldon Axle and Spring Company

Makers of Springs and Axles for More Than 50 Years

WILKES-BARRE PENNSYLVANIA

Chicago: 122 S. Michigan Blvd. **Detroit: 1215 Woodward Avenue** **San Francisco: 444 Market Street**



Accessibility, lubrication, cooling and fuel supply—these are the stumbling blocks that had to be overcome in designing and producing an efficient V type 8 cylinder motor—a motor of the character and quality of the Spillman 8.

And it was in the surmounting of these obstacles that the Spillman 8 first came into popularity.

Today, the Spillman 8 is offered as the most efficient and most highly developed 8 cylinder motor on the market.

Every part of the Spillman 8, even the valve mechanism, is extremely accessible.

The Spillman oiling system is conceded generally to be the most efficient in use. Every bearing receives a constant positive supply of clean oil under pressure—and the delivery is absolutely uniform in both blocks of the motor.

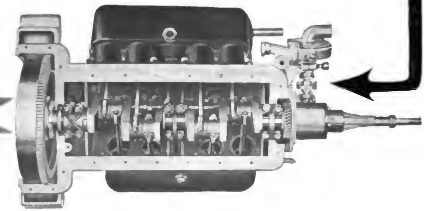
SPILLMAN "8"

Positive cooling at all speeds is assured. The water enters the cylinders at the lowest point and emerges directly over each exhaust valve. The inlet pipes are cast in the cylinders and the exhaust pipes are bolted on.

Great care has been taken in the manifolding to insure an even, constant supply of fuel equally to both blocks of the motor.

The fact that Herschell-Spillman Company has expertized for years in the production of high quality and highly efficient aeroplane motors with great success is reflected in the all-around superiority of Spillman motors for motor car practice.

Herschell-Spillman Co.
North Tonawanda, New York



We Are Doing What All Other Makers Are Struggling in Vain to Do

We are making a car which runs with a soft, smooth, gliding motion—without any noise or vibration at any speed—without any shifting of gears—and with a driving power which is absolutely uniform and continuous—and whose fuel is kerosene. But far beyond that, we are doing

What No Other Maker Is Even Attempting to Do

We are delivering this absolutely uniform and continuous driving power without any gears to shift, without clutch, flywheel, carburetor, ignition system or self-starter, and without any substitute devices to perform the functions of these. The functions themselves are simply not a part of the Stanley car. And we are doing it with

Only 32 Moving Parts in the Complete Vehicle

—with only two cylinders, with only 894 revolutions a minute at sixty miles an hour, and with no controlling device whatsoever except a finger throttle. There is absolutely nothing that the operator can do to control the speed of his car except to move this finger throttle forward and back on its quadrant, and apply the brakes. This is the ideal performance that you have been longing for.

Other makers have recognized your longing, and have made honest endeavors to achieve the ideal. But the limitations of the internal explosive engine are such that to adapt it to a self-propelled road vehicle means the interposition between the engine and the driving wheels of a clutch, a flywheel, a gearshift and a transmission; and without any possibility of storing power except in the flywheel. It means trying two, four, six, eight and twelve cylinders; it means trying electric gear shifts, electric final drives, friction drives, two-speed rear axles, over three thousand engine revolutions and upwards of thirty thousand piston revolutions a minute. Makers of multiple cylinder cars, recognizing the fundamental superiority of steam for a self-propelled road vehicle, have advertised that their cars were "almost as flexible as steam."

The Ideal Performance of the Stanley is based on three fundamental facts. First, the engine is geared directly and permanently to the differential; the engine speed is the same as the car speed; there is no such thing as shifting gears, and therefore no such thing as a clutch or a flywheel and no such thing as disconnecting the power from the load; to "change speeds" you merely admit more steam to the engine. Second, the steam enters the cylinders and exerts its force expansively, not explosively, and not in a series of "impulses," not even "overlapping impulses," but in a smooth, continuous torque on the crankshaft, which means a constant flow of driving power. Third,

The Fuel, Which Is Kerosene,

is converted, not into mere instantaneously dissipated power, but into steam, which is stored in great abundance for critical emergencies, and can be instantly applied to the driving wheels by merely opening the finger throttle, without waiting for the power to be built up into a flywheel, and which delivers its very maximum of power under the most adverse conditions.

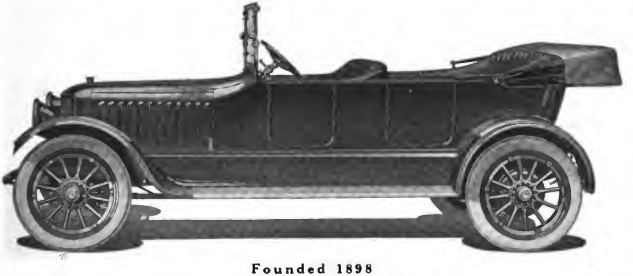
You Want This Wonderful Performance

—you would want it, even if it were achieved by the addition of still more contrivances to your present conventional car. How much more, then, do you want it if it is achieved by eliminating all those hardships and handicaps which have been most fearsome to you?

Ride in a Stanley—drive it yourself. Then and then only can you realize what this Stanley performance means to you.

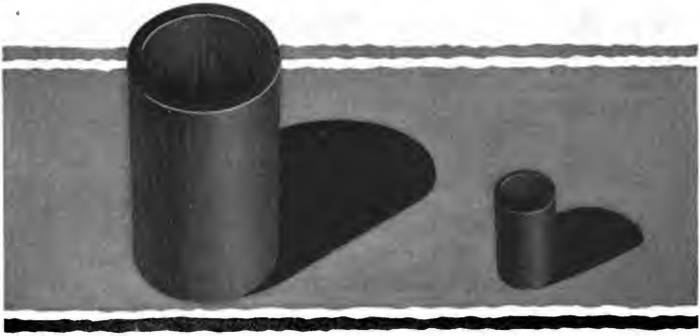
You don't want to miss getting EXACTLY WHAT you have been longing for by overlooking the Stanley, do you? We shall be glad to hear from you, and to send our booklet

The Stanley Touring Car is $1975, f. o. b. Newton, Mass. Wire Wheels $90 extra. Wheelbase, 130 inches—Tires, 34x4½ Silvertown—Warner Speedometer—Timken Bearings and Front Axle—Klaxon Horn—Warner Steering Gear—Mayo Radiator—Aluminum Body—12 Miles to the Gallon of Kerosene—200 Miles to a Tank of Water.



Founded 1898

STANLEY MOTOR CARRIAGE CO., NEWTON, MASS.



TWO MILLION

of these "NIGRUM" Impregnated Wood OIL-LESS BEARINGS are going to consumers this year.

Year by year the demand for these bearings has doubled and quadrupled. Manufacturers are quick to recognize through actual demonstration the big Economy and Efficiency that results from the use of these light, long-wearing, self-oiling bearings.

The LEADING MOTOR CAR MANUFACTURERS know, by experience, that a car will last only as long as its non-adjustable bearings. They know that there are certain bearings which are difficult or impossible to keep properly lubricated—and an ordinary bearing that is not kept properly lubricated quickly wears out. Naturally then they use "NIGRUM" OIL-LESS BEARINGS in order to insure long and satisfactory service for their cars.

In motor cars, aeroplanes, submarines, armored trucks, where so much depends upon continuous, unbroken running of machinery, these bearings are standing up and delivering service—oiling themselves and requiring no attention—in a manner and for a length of time that no ordinary bearing can approach.

ALL BEARINGS MADE TO ORDER

All genuine Graphited Oil-less Bearings are made by

BOUND BROOK OIL-LESS BEARING COMPANY

Specialists in the manufacture of Oil-less Bearings for more than a quarter of a century

BOUND BROOK NEW JERSEY

Also manufacturers of "BOUND BROOK" Graphite-and-Bronze Oil-less Bearings

- NIGRUM -
OIL-LESS BEARINGS

1893 1917

A Haynes Dealership Is a Business Fortification. 24 Years' Continuous Haynes Success Is Its Most Forceful Recommendation

A Limited Number of New Haynes Dealerships Are Now Available for 1917. Wire, Write or Call at the Factory for Full Particulars : : :

THE HAYNES AUTOMOBILE COMPANY
3 S. Main St. Kokomo, Indiana

We want you to handle "H.A.L. Twelves" in your Territory. If you're the right man we'll pay your expenses to Cleveland.

They say:

Jim Corbett says:—
"I know it's a good car, say anything you want to."

An old lady in Indianapolis said:—
"Riding in any car is like going some place; riding in an "H.A.L. TWELVE" is like being there."

Mr. John Richards of the Royal Auto Club said:—
"Makes the world all level."

The Washington Times, 9-4-16:—
"One of the most striking."

We say:

The strong Syndicate of Cleveland manufacturers that owns the H. A. Lozier Company, insist upon a policy which will not let a Dealer handle "H. A. L." cars, unless he can make money with them, otherwise we won't let you start.

Our national advertising is producing results for dealers. The "H. A. L." has jumped into public favor. There are several hundred running and giving their owners satisfaction and this list is increased each day by about ten new satisfied purchasers. Read the opinions.

The gasoline consumption is low in the "H. A. L.," ranging from 13½ to 16 miles per gallon, making the "H. A. L." the most economical car of its size in the world.

The fifty additional dealers that we can now supply with cars must be prepared to make money with this account. We are limiting the number of dealers to the number we can satisfactorily supply and render service to. If you want a profitable multiple cylinder car agency—the "H. A. L.

Billy Stevens says:—

"Ever see such a get-away."

New York Globe, 9-3-16:—

"Veterans will sell the 'H.A.L. TWELVE.'"

Senator Harding:—

"Bought one."

Chicago Daily News, 9-2-16:—

"A car with maximum flexibility."

Cleveland Plain Dealer, 9-1-16:—

"Tasty lines in the 'H.A.L. TWELVE.'"

A man in St. Louis says:—

"It's like stepping on a thick Oriental rug."

Jay Bersh says:—

"Just like a rubber band."

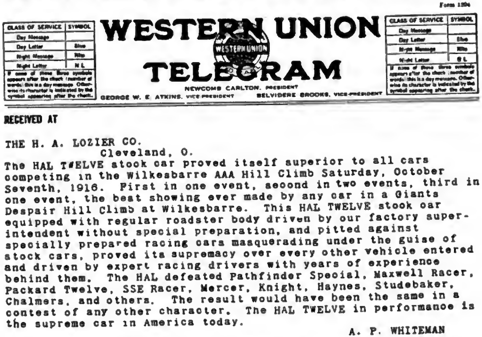
Mr. Woodruff, Northern Ohio Distributor, said:—

"The 'H.A.L.' car is the easiest selling car I ever handled."

TWELVE"—get your application in at once.

Under our method of dealers' assistance, you can make more money with the "H. A. L. TWELVE" than with any other car in the United States.

THE "H.A.L" PROVED SUPREME IN WILKES-BARRE HILL CLIMB



Form 1204

CLASS OF SERVICE	SYMBOL
Day Message	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise its character is indicated by the symbol appearing after the check.

WESTERN UNION TELEGRAM

NEWCOMB CARLTON, PRESIDENT

GEORGE W. E. ATKINS, VICE-PRESIDENT BELVIDERE BROOKS, VICE-PRESIDENT

CLASS OF SERVICE	SYMBOL
Day Message	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise its character is indicated by the symbol appearing after the check.

RECEIVED AT

THE H. A. LOZIER CO.
Cleveland, O.

The HAL TWELVE stock car proved itself superior to all cars competing in the Wilkesbarre AAA Hill Climb Saturday, October Seventh, 1916. First in one event, second in two events, third in one event, the best showing ever made by any car in a Giants Despair Hill Climb at Wilkesbarre. This HAL TWELVE stock car equipped with regular roadster body driven by our factory superintendent without special preparation, and pitted against specially prepared racing cars masquerading under the guise of stock cars, proved its supremacy over every other vehicle entered and driven by expert racing drivers with years of experience behind them. The HAL defeated Pathfinder Special, Maxwell Racer, Packard Twelve, SSE Racer, Mercer, Knight, Haynes, Studebaker, Chalmers, and others. The result would have been the same in a contest of any other character. The HAL TWELVE in performance is the supreme car in America today.

A. P. WHITEMAN

The above telegram shows what Mr. A. P. Whiteman, our Philadelphia Dealer, who was at Wilkes-Barre at the time of the race, thought regarding the performance of the "H. A. L. TWELVE."

The HALozier Co.
90 East 72nd St. Cleveland. Ohio.

APPLICATION FOR TERRITORY

The large number of requests for territory and the fact that we never appoint a Dealer for the "H. A. L. TWELVE" unless we are sure that he is going to succeed, make this application blank necessary.

Answer the following questions as accurately as possible:

Firm Name..
Address ....
City ....

If a partnership, names of partners
If a corporation, names of officers and directors
....
....
....
How many years have you been established......
What makes of cars do you handle..................
....

What territory do you control on these cars........
....
Have you a salesroom.....................................
How many salesmen do you employ....................
Are you prepared to give ordinary service..........
Do you handle accessories...............................
....
Name of Applicant

Firestone

Perfect Service

A set of Firestone Tires doubles your motoring pleasure and is a mighty stroke towards most miles per dollar in car and tire upkeep. Firestones are tires of brawn, balance and beauty, backed by an organization of specialists whose watchword is "Service to the Motoring Public." Let your dealer serve you.

FIRESTONE TIRE AND RUBBER COMPANY, AKRON, OHIO
Branches and Dealers Everywhere *"America's Largest Exclusive Tire and Rim Makers"*

Garagemen Write!

W'RIGHT COMPRESSION TIGHT PISTON RINGS

Repairmen Write!

INSTALL THEM NOW!

DEALERS: The W'RIGHT Piston Ring business is booming. Your opportunity for selling W'RIGHT Rings to every car owner who comes into your place of business is greater now than ever.

One Half the Price of Ordinary Multiple Type Rings

Patent applied for

Note perfect simplicity—two perfect eccentric rings, slots cut right and left and kept separated to a position of 90° by a dowel pin—so that each ring seals the joint or slot in the opposing ring. Compression is held—oil cannot work past.

Without a Superior in Material, Workmanship or Performance

Consider that the low price of W'RIGHT Rings permits car owners to install a complete set of rings where otherwise they could use one or two high-priced rings at most to a piston.

Complete satisfaction is not to be obtained with anything less than a complete set of piston rings. W'RIGHT prices have been made low enough to stimulate complete set installation, in the knowledge that only by so doing can perfect results be assured.

Dealers are authorized to sell every complete set of W'RIGHT Piston Rings with the understanding that they can be returned at any time within 30 days for any reason whatever, and their full purchase price refunded. W'RIGHT RINGS can now be obtained at almost every live garage or repair shop.

This guarantee naturally applies only to W'RIGHT installation on pistons which are round and unscored.

W'RIGHT dealers report that they are smashing all previous sales records. The low price of W'RIGHT Rings, added to their exceptional qualities, give them the call. If you are not getting your share of the piston ring business in your vicinity, you are overlooking interesting profits in a big and growing business. Everything indicates that more W'RIGHT Piston Rings will be sold in 1917 than any other type of fuel economizer on the market.

Our factories are working overtime to meet the demand. If you recognize the big possibilities and the permanence of the W'RIGHT agency, we want you—now! Get in line for the spring trade. Every time that gasoline goes up, more W'RIGHT Rings will be sold. Wire, or use the coupon today for interesting dealers' proposition.

V. A. LONGAKER COMPANY

Sole Distributors

Suite 706, Merchants' Bank Bldg., Indianapolis, Ind.

DEALERS' COUPON

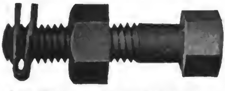
V. A. LONGAKER,
706 Merchants' Bank Bldg.,
Indianapolis, Ind.

Please send full details of special dealers' proposition.

Name ....

Address ....

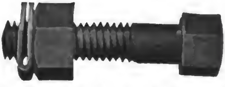
....



Spring Nut Lock, loose, applied on bolt before being set in place to hold until taken off

Front view

Rear View



Spring Nut Lock tightened against Nut. Prevents shaking off—follows nut tightening against material

Will Firmly Lock All Nuts in Place on the Cars or Parts You Manufacture

SPRING NUT LOCKS

save the *countless* losses that are constantly occurring wherever machines are run and part is fastened to part by nuts and bolts

Better Be Safe Than Sorry

Whether you manufacture or sell any part of an automobile from the radiator to the rear axle *see to it* that every nut is ***safely,*** **SECURELY, PERMANENTLY** locked in place on its bolt with a *Spring Nut Lock*

Increase the ***reliability,*** **DURABILITY, STABILITY** of your motor, tractor, battery or what not by slipping on over *every* nut that engages a thread this simple, light, cheap and positively *efficient* device that holds any nut permanently in place and yet may be released at will—when lock, nut and bolt are as good as ever and can be used over again as often as desired.

You cannot afford to be without *Spring Nut Locks.* You cannot afford the loss of prestige, the mental worry, the risk of serious losses in life, limb and pocket-book that are liable to occur at *any moment* where vibration can start nuts loosening that are not properly locked in place, but are yet expected to hold vital parts. *The Spring Nut Lock is your safety insurance.*

In anticipation of the great volume of advance orders that have already begun to pour in on us as the merits of this great little device is becoming known to the mechanical world, we have let contracts for the manufacture of *Spring Nut Locks* to The Stowell Company of South Milwaukee, Wis., who have one of the largest plants in the country adapted to turning out this safety necessity in the enormous quantities it will be needed.

The Lock slips on the bolt like a washer and as easily *—economy of time in application.*

Its cost to the user is a mere trifle more than a washer *—the initial economy.*

It will not cut the thread of the bolt—*enduring economy*

Its cost will be little more than that of the simple washer, cheapest of all devices.

Price lists will be issued soon. Write us for your probable needs NOW. Get in line to get *your share of this first output.* Send us your name and business and get our *first price lists* when issued.

Spring Nut Locks for Standard Threads for the following sizes are scheduled for delivery on or before October 15th ⅜ in., ½ in., ⅝ in., ¾ in., ⅞ in. and 1 in. By November 1st we will try to supply all standard and special sizes and by January 1st we are in hopes to be able to fill all orders promptly, however large. In the meantime look out for your own needs by getting in touch with us immediately. Allotments will be made from first output in proportion to the size of the advance order filed with us. Orders filled in rotation as received.

Spring Nut Locks for S. A. E. Standard Thread for automobile use have been thoroughly tested out and have aroused the enthusiasm of automobile men wherever tried. Locks for S. A. E. Standard Threads for 5/16 in., ⅜ in., 7/16 in., ½ in. and 9/16 in. are also in preparation and will be ready about the same time. Get in your orders at once.

Jobbers, Garage Men—all Dealers—should take steps to supply the early demand of their customers for Spring Nut Locks. **Manufacturers** who take pride in their product should be prepared to adopt them. Railroads where economy and safety are first must have them. Write us your needs today and let us help you.

SPRING NUT LOCK COMPANY

648 Transportation Bldg. :: :: :: :: :: Chicago, Illinois

Every Ford Owner Is Your Prospect for This Ford Necessity

MODERN business demands that you seek every prospect and sell him—that is efficiency. Pick those things which motorists need, stock them and see that you sell them.

The vast host of Ford owners in your territory should be made profitable prospects—but what have you to sell them that is worth while, that is essential, that you can back up?

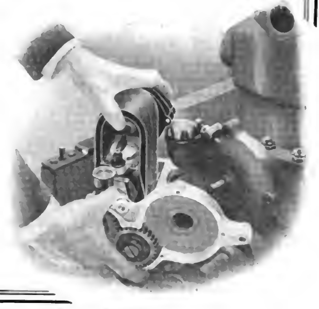
The Bosch-Ford Attachment

It is a necessity for Fords, not a luxury. It is an accessory that gets out of the car more vim, vigor and snap than the owner imagined ever was in it. One of its main features is that it eliminates the ignition trouble, the missing, the overheating and other difficulties due to poor ignition.

Go after this Ford Business, now. We will help you with circulars, letters and helpful suggestions if you will do your part. Our state distributors will help you, too. Start today.

Write for literature—
order a sample outfit.

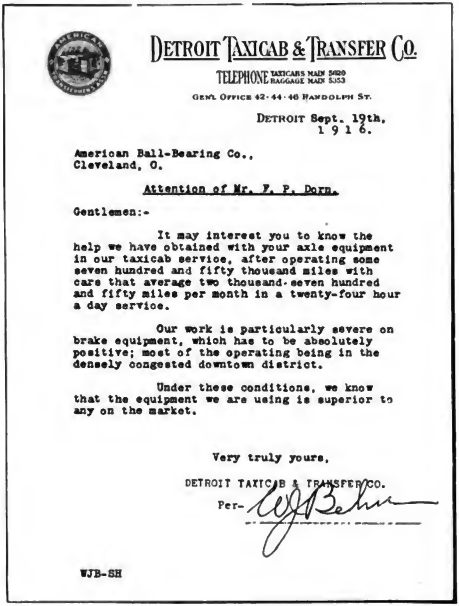
BOSCH MAGNETO CO.
220 West 46th St.
New York


It's very easy to install

The entire fleet of Detroit Taxicab and Transfer Co. is equipped with

American Axles

The Quick STOP and GO



DETROIT TAXICAB & TRANSFER CO.

TELEPHONE TAXICABS MAIN 5020
BAGGAGE MAIN 5353

GEN'L OFFICE 42·44·46 RANDOLPH ST.

DETROIT Sept. 19th,
1 9 1 6.

American Ball-Bearing Co.,
Cleveland, O.

Attention of Mr. F. P. Dorn.

Gentlemen:-

It may interest you to know the help we have obtained with your axle equipment in our taxicab service, after operating some seven hundred and fifty thousand miles with cars that average two thousand-seven hundred and fifty miles per month in a twenty-four hour a day service.

Our work is particularly severe on brake equipment, which has to be absolutely positive; most of the operating being in the densely congested downtown district.

Under these conditions, we know that the equipment we are using is superior to any on the market.

Very truly yours,

DETROIT TAXICAB & TRANSFER CO.
Per-

WJB-SH

THE AMERICAN BALL-BEARING CO.

Licensed Under the Kardo Co. Patents

Pioneer Axle Builders of America **CLEVELAND, OHIO**

DEALERS KNOW

—Take their word for it

Where you have one set of springs on your car, the large dealer and garage man comes in contact with a thousand sets of different kinds of springs—he ***knows*** springs—and here is what he says in regard to the Tuthill Titanic Spring.

"We have been selling Tuthill Titanics for a couple of years and never had to replace one."—*Central Garage and Supply Co., Jacksonville, Fla.*

"All of our customers are perfectly satisfied, without exception."
C. Jim Stewart & Stevenson,
Houston, Texas.

POSITIVE

"We have sold 150 Tuthill Titanics and as yet have not found one that failed to give entire satisfaction. We have had some customers who broke 7 or 8 springs before putting on Tuthills."—*Anderson & Benson, Austin, Texas.*

"We have sold several hundred of them—we consider the Tuthill Titanic to be the best spring on the market."—*Webb Auto Co., San Angelo, Texas.*

"Once you have sold a man a Tuthill Titanic you have made a friend forever."—*Havre Auto Co., Havre, Mont.*

"We find Tuthill Titanic Springs easy to sell because car owners like the guarantee feature."—*Motor Inn Co., Albert Lea, Minn.*

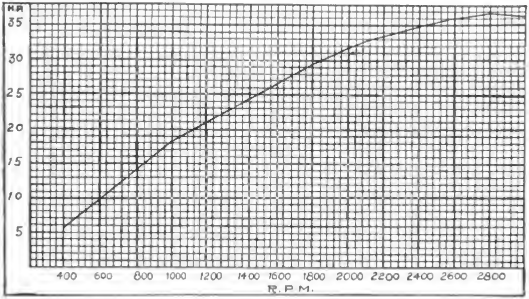
When you replace a spring, ask for "Tuthill Titanics"—No Center Hole—No Center Nib—No Center Breakage.

TUTHILL'S TITANIC
NO CENTER BOLT

Write to Tuthill Spring Co., 754 Polk St., Chicago, Ill., for Guarantee and ask for Free Book, "The Spring That Outlasts Your Car."

PROOF

The Power Curve



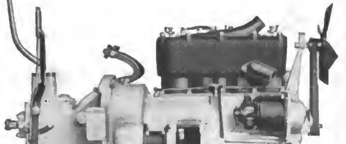
G B & S motor

THE illustration clearly indicates the power efficiency of G. B. & S. Motors.

Observe that this motor develops 22½ actual brake horse-power at 935 feet of piston speed per minute instead of at 1000 feet according to the S. A. E. formula.

At 2800 r.p.m. it develops 36.9 horse power. This power efficiency is backed by efficiency in every detail.

Cylinders are 3¾ in. bore x 4¾ in. stroke—cast en bloc with detachable cylinder head. Thermo-syphon cooled. There are three main bearings, all extra large. Valves are unusually large. Crankshaft is big and strong.



It requires only four bolts to install motor in chassis.

The "G. B. & S." motor is built for hard service and long life. It is adaptable to several varieties of transmissions—and provision is made for easy installation of standard starting and lighting systems.

We are furnishing this unit power plant for both pleasure and commercial cars—and have been building good motors for seven years.

We make this one size and style only, and thus are in a position to increase production rapidly.

Blue prints and full details gladly furnished on request.

Golden, Belknap & Swartz Co.

Detroit, Mich.

INDIANAPOLIS
STUTZ
INDIANA. U.S.A.
World's Champion

WORLD'S
Speedway Champion

WORLD'S
Road Race Champion

World's Long Distance
Records 300; 350 – miles

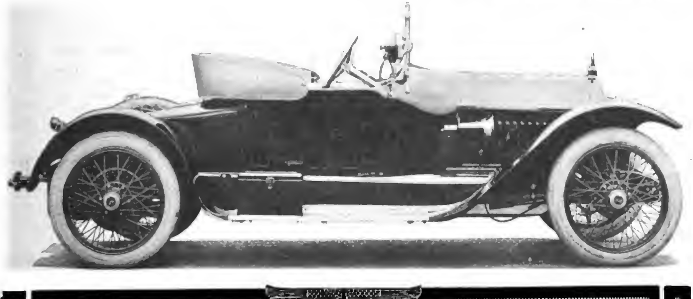
World's Record for Consistency
4 Consecutive 1st & 2nds

These Records Still Stand

Stutz Racing Records are unequalled after two years of competition by the better motor mechanisms of America and Europe, for the same reason that the Sturdy Stutz is giving unequalled service in owners' hands.

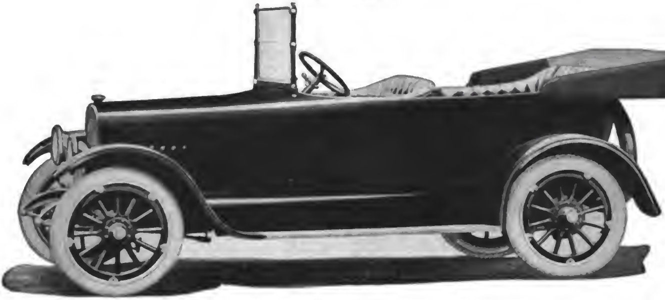
STUTZ MOTOR CAR CO.
Indianapolis, Indiana, U. S. A.

Stutz Roadster $2,550
Other Models $2,275 and $2,550



STUTZ

REGAL MOTOR CAR CO.
REGAL
DETROIT



Regal-4-thirty-two

BUILT TO THE ORDER OF POPULAR DEMAND

For nine years we have built cars of quality and merit at moderate prices.

The Regal-4-thirty-two is the culmination of these nine years of studying motor improvements, of standardizing factory efficiency, of feeling out the pulse of popular demand.

The Regal-4-thirty-two is the Biggest Car in the Light Class—namely among cars selling from $650.00 to $750.00.

Motor 3⅛" bore—stroke 4⅝"—detachable head—develops full 32 H. P.

Long wheelbase of 108 inches for unlimited comfort.

Gasoline tank at rear with vacuum feed to motor.

$695

Front seat 42 inches wide—rear seat 49 inches wide—cantilever springs.

2 unit starting and lighting system—magneto type.

Furnished in very best grade semi-gloss upholstery.

Fully equipped.

It is the biggest value in size, power and style.

The specifications show this claim to be an actual fact, not an advertising phrase—and you will find that the Regal-4-thirty-two runs true to form on specifications.

If you are interested in handling a car that will sell on looks and performance against anything of its size and price in the 1917 market, write us at once.

We may have a proposition for you among the few open territories that are yet unallotted.

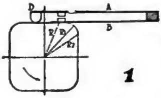
Regal Motor Car Co. (Dept. C) Detroit, Michigan

Capacity and endurance
assured by unequalled
accuracy and uniformity
throughout the bearing.

Gurney Ball Bearing Co.
Conrad Patent Licensee
Jamestown, New York
Chicago, Ill. New York City

No Trips, Hammers or Light Springs

—are depended upon for the action of the



1

PITTSFIELD DISTRIBUTOR

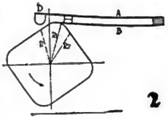
—which provides for a positive, unfailing, mechanical making and breaking of circuit, entirely independent of spring action.

As can be seen by accompanying illustrations, the revolving cam first pushes lever "C" into contact with lever "A," then lifts the platinum point on lever "A" away from contact with similar point on lever "B," mechanically breaking the contact. This special design

Permits an Open Circuit

—which means that you use current only when needed to produce sparks.

These illustrations indicate roughly the make-and break action. As the cam revolves it forces the two small contacts on A and B together at the corner of the cam, thus making the circuit. In the same cycle—that is, as the cam revolves in the direction of the arrow—the cam breaks the circuit by separating the contact points, as in Fig. 3. Note, however, that the making and breaking are not dependent upon the flat spring arms A and B, but rather on the positive mechanical cam action. This is true because even if the arm B at its contact point were to remain suspended in the air the continued rotation of the cam would still lift the arm A away from the arm B. First, the revolution of your cam positively and mechanically makes your circuit, and then, irrespective of any spring action, positively and mechanically breaks the circuit.



2

Owing to the short duration of the contact, your current consumption is exceedingly small; at the same time the contact is so firm and certain that it insures

Hot Sparks at Highest Speeds

—of which your engine is capable, in fact its capacity is *in excess* of the highest engine demand.

Owing to the simplicity and positive action of the breaker mechanism,

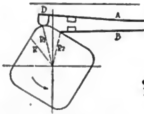
Electrical and Mechanical Lags Are Practically Eliminated

—and the synchronization of the timing is as nearly perfect as is humanly attainable.

The whole ignition outfit is compact and made into a single unit, including the coil, so that

Only One External Wire

aside from the spark plug leads, is used. This, of course, is the lead to the battery.



3

PITTSFIELD SPARK COIL COMPANY

Pittsfield **Mass.**

MOTOR PRODUCTS CORPORATION

Announcing an Organization of Great Importance to the Automobile Builder

We recently completed the formation of the Motor Products Corporation, an actual working organization perfected to take over the business, good will and operating plants of the Rands Manufacturing Company, the Vanguard Manufacturing Company, the Diamond Manufacturing Company, the Superior Manufacturing Company and the Universal Metal Company.

The Motor Products Corporation will continue to manufacture and sell the products formerly manufactured by its constituent companies—hub caps, radiator parts, tubing, windshields and other automobile parts. The same high quality that marked the output of the smaller companies will be evident in that of the Motor Products Corporation, with the additional advantages of greater economy in production and more efficient service for those motor car manufacturers whom we supply.

To this end we have recently acquired the entire factory and office group of the Lozier Motor Company, in Detroit, where the bulk of our manufacturing operations will be conducted as a unit. The factory at Ann Arbor, Mich., will still be maintained for special work, and the Canadian factory at Walkerville, Ont., will be maintained and enlarged to care for the rapidly growing Canadian business. In this way we will be able to realize, without delay, all the advantages resulting from the conduct of our organization as one immense, efficient unit, instead of a number of separate factories as heretofore.

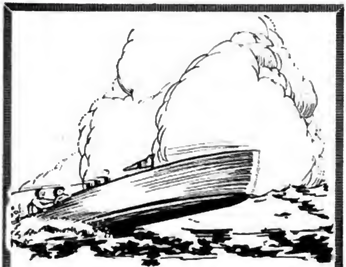
MOTOR PRODUCTS CORPORATION
DETROIT, MICH.

W. C. Rands, President.	D. B. Lee, Treasurer and Gen'l Mgr.	C. F. Jensen, Vice-Pres. and Director of Purchases.
H. H. Seeley, Vice-Pres. and Director of Sales.	R. R. Seeley, Production Manager.	M. L. Brown, Secretary.

Main Office and Factory, Detroit, Mich.

Factories at Ann Arbor, Mich., and Walkerville, Canada.

Successors to
Rands Mfg. Co. Superior Mfg. Co.
Vanguard Mfg. Co. Diamond Mfg. Co.
Universal Metal Co.



The Exhilaration of Riding the Waves in a Speedboat is Nearest Duplicated on Land by

W & C

Original Double Arm Shock Absorbers On Your Ford Car

The magnetic attraction of the speed boat for its pilot lies in the sensation that comes from guiding a craft of its pliability through the water at high speeds.

It is the pliability of the W & C equipped Ford, its road-fitness at all speeds, its absolute freedom from sharp jerks and jolts that reproduces that sensation on the highway.

The exhilaration of driving an easy-riding Ford is yours when you *say "W & C" to your dealer.* Say it *today.* It will pay.

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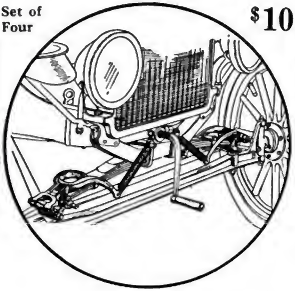
Set of Four **$10**



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Transmits the power from the starter to the motor on

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MADE BY THE
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G & O MFG. CO.
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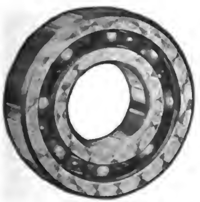

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If ever any one adaptation showed the super-efficiency of ball bearings it is their use in tractor building.

Slewing and skidding and jolting over rough farm lands and ditches, the tractor is subjected to unusual and exceptional strains such as are seldom encountered by any other piece of machinery. From every direction they come—these unusual jolts and blows—until one marvels that the mechanism stands up at all.

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The Standard Spark Plug of America

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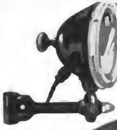

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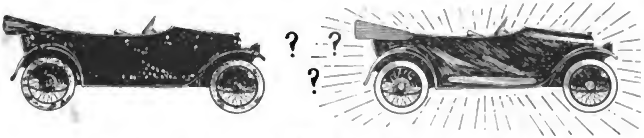

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"Clover Leaf" Type Roadster, seating comfortably four passengers.

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Built To Serve Not Merely To Sell

After it has been used a season—
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Better get our samples and prices—right now.

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This is the magneto that starts without Batteries any Motor. It is the NEW

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For multicylinder automobile and truck motors

This magneto fires any kind of fuel. It operates any number of cylinders up to 12. Without Impulse Starter, known as Model T. Both the T and T-K are entirely enclosed as protection against water, oil and dirt.

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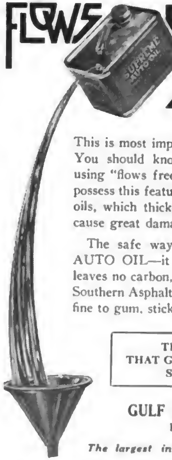

This is most important during winter months. You should know whether the oil you are using "flows freely at Zero." All oils do not possess this feature—notably the paraffine base oils, which thicken up under cold, and often cause great damage to the motor.

The safe way is to ask for SUPREME AUTO OIL—it "flows freely at Zero," and leaves no carbon, owing to the fact that it is a Southern Asphalt-base oil, containing no paraffine to gum, stick or thicken.

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The largest independent refining company in the world.

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"I have had considerable experience in the past two years with your high tension magneto, but no trouble. Mine has run two years, have never changed or cleaned a spark plug, and they are still good, and so is the magneto."
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Quality **Reliability**
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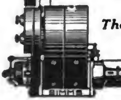

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It's the ignition! With a hot, strong spark your motor throbs with power! You'll get that kind of spark from an

EISEMANN MAGNETO

A spark that's hot, intensely hot, at all speeds, even the lowest—sure fire for any mixture, however lean—quick pick-up—easy starting—that's Eisemann ignition!

Why do you suppose the Eisemann Magneto is the standard equipment of 108 Manufacturers? If you can't guess, ask them!

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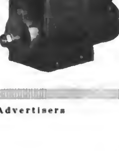
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Some common greases are trying to trade our reputation. They imitate the *name,* but they cannot equal the *quality.*

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It is stamped in black on orange colored cans *only.* Best dealers sell and recommend NON-FLUID OIL.

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Booklet on Special Ford Equipment

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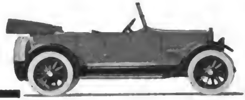

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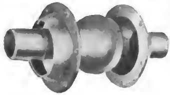

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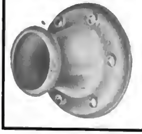

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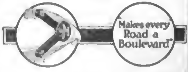
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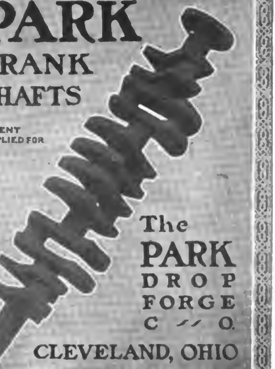

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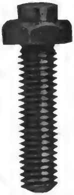

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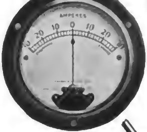

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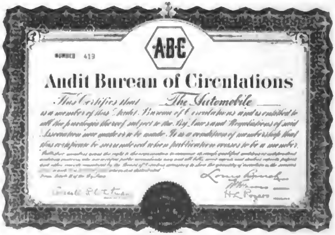

ABC

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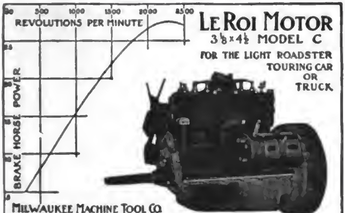

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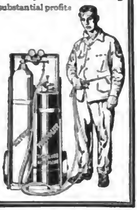

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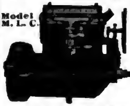

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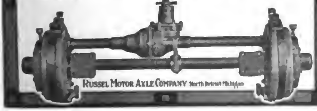

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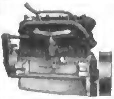

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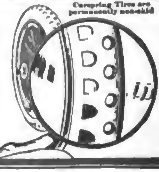
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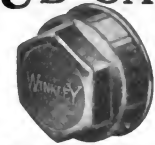

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See our ad on page 90

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34x3½	10.00	2.55
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31x4	12.25	2.90
32x4	13.00	3.20
33x4	13.25	3.25
34x4	13.75	3.35
35x4	14.00	3.45
35x4½	17.50	4.15
36x4½	18.00	4.25
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31x4	6.25	1.65
32x4	7.00	1.60
33x4	7.25	1.70
34x4	7.75	1.70
35x4	7.50	1.75
36x4	7.50	1.75
34x4½	8.00	1.75
35x4½	8.00	1.80
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Bosch Magnetos and other Motors—low price.
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TIRES

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Size	Plain	Non-Skid	Tubes
28 x 3	$5.25	....	$1.80
30 x 3	5.50	$6.75	1.90
30 x 3½	6.95	7.50	2.15
32 x 3½	7.95	8.75	2.25
34 x 3½	8.85	9.75	2.35
30 x 4	9.45	10.50	2.85
31 x 4	9.65	10.60	2.95
32 x 4	9.75	10.75	3.05
33 x 4	9.85	10.85	3.10
34 x 4	9.95	10.95	3.20
35 x 4½	10.45	11.45	3.30
36 x 4	10.95	11.95	3.35
34 x 4½	12.45	13.45	4.00
35 x 4½	12.95	13.95	4.10
36 x 4½	13.50	14.50	4.15
37 x 4½	14.45	15.45	4.25
35 x 5	15.00	16.00	4.90
36 x 5	15.45	16.45	4.95
37 x 5	15.95	16.95	5.05

Deposit required on C.O.D. orders

AKRON TIRE CO., Inc.

Authorized Capital, $300,000.00

1789 Broadway, Corner 58th Street
NEW YORK

DOUBLE SERVICE TIRES
Guaranteed 3500 Miles

Size	Plain	Tubes	Size	Plain	Tubes
30x3	$5.00	$2.05	36x4	$9.00	$3.80
30x3½	6.00	2.40	36x4½	10.00	4.60
33x4	8.00	3.45	36x5	11.00	5.45
34x4	9.00	3.60	37x5	11.00	5.55

Non-skid Tires, all sizes, $1.00 Extra.
State if Q. D. straight bead or clincher type.
10% Deposit required on all C. O. D. orders.
Discount of 5% when cash accompanies order.
I. Jaffess, 1319J Fifth Ave., New York.

Reduce Your Tire Bills
by using our
DOUBLE TREAD TIRES

30 x 3½........$6.00 34 x 4..........$8.00
36 x 4½........$10.00

Write for Illustrated Catalogue and Price List to
B. Liben & Co., 201 W. 54th St., New York.

Ford Owners

Special Reduction Sale

ON HIGH GRADE NEW TIRES FOR FORDS

30x3 plain	$5.75
30x3 non-skid	6.25
30x3½ plain	6.75
30x3½ non-skid	7.25
30x3 new tubes	1.10

A glimpse at these tires should force you to purchase your tire needs for months to come.

4000 Miles Certificate of Guarantee With Our New Tires Below.

BEST VALUES: LOWEST PRICES: OUR ADVERTISEMENTS

	Tires	Tubes		Tires	Tubes
28x3	$ 6.25	$1.25	36x4	$14.70	$3.65
31x3½	8.50	2.50	37x4	17.25	3.75
32x3½	9.45	2.50	34x4½	15.80	4.10
34x3½	9.95	2.55	35x4½	17.50	4.15
36x3½	11.45	2.75	36x4½	17.50	4.25
31x4	11.75	2.90	37x4½	18.00	4.35
32x4	12.25	3.25	36x5	18.00	5.10
33x4	12.75	3.30	35x5	17.50	4.95
34x4	13.25	3.35	37x5	19.90	5.20
35x4	14.00	3.45	37x5½	28.50	5.00

Add 10% for non-skid.

Superseding all former price lists.

1500 Miles Certificate of Guarantee With Our Used Tires

	Tires	Tubes		Tires	Tubes
30x3	$3.50	$1.35	36x4	$7.50	$1.75
30x3½	4.25	1.45	32x4½	7.00	1.60
31x3½	4.50	1.50	34x4½	8.00	1.75
32x3½	5.25	1.50	35x4½	8.00	1.80
34x3½	5.50	1.60	36x4½	8.25	1.60
31x4	6.25	1.65	37x4½	9.50	1.90
32x4	7.00	1.60	35x5	8.50	2.00
33x4	7.25	1.70	36x5	9.50	2.10
34x4	7.75	1.75	37x5	9.75	2.20
35x4	8.00	1.80	39x5	11.25	2.50

One dollar deposit or sufficient to defray express charges required with each order. Shipments made promptly C. O. D. subject to your inspection.

Auto Sales & Parts Co.

1602 So. Michigan Ave. CHICAGO

BIG BARGAINS IN REGULAR STANDARD GUARANTEED 3500 MILES TIRES and TUBES

SHARE OUR PROFITS

Size	Plain	Non-Skid	Tubes
28x3	$ 6.35	$ 7.00	$1.75
30x3	6.95	7.45	1.85
30x3½	8.95	9.50	2.05
32x3½	10.30	10.85	2.20
34x3½	11.50	12.15	2.25
32x4	14.10	14.85	2.75
33x4	14.65	15.45	2.85
34x4	14.95	15.75	2.90
35x4	15.55	16.50	3.00
36x4	15.80	16.60	3.10
35x4½	20.80	21.85	2.75
36x4½	21.10	22.15	3.85
37x4½	21.85	22.95	3.95
37x5	24.00	26.25	4.50

FULL LINE OF SLIGHTLY USED ALL STANDARD MAKES TIRES AND TUBES
Will run from 1500 to 3000 Miles

Size	Tires	Tubes	Size	Tires	Tubes
28x3	$3.25	$1.00	35x4	$7.25	$1.75
30x3	3.50	1.25	36x4	7.25	1.75
30x3½	4.25	1.35	34x4½	7.50	1.75
32x3½	5.00	1.40	35x4½	7.75	1.80
34x3½	5.75	1.45	36x4½	8.00	1.80
31x4	6.00	1.50	37x4½	8.50	1.85
32x4	6.50	1.45	35x5	9.00	1.90
33x4	6.75	1.65	36x5	9.50	1.95
34x4	7.00	1.60	37x5	9.50	2.00

Tires shipped C. O. D. subject to examination, on receipt of $1.00 for each tire.

Armstrong Tire & Vulcanizing Co.
Branch
1614 Michigan Ave., 1336 Michigan Ave.
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DOUBLE TREAD TIRES

Now Known and Proven

to be the best double-tread tire on the market

LIBERALLY ADJUSTABLE ON A 4000-MILE BASIS.

Our tires are relined so no stitching on inside can injure your tubes.

Size	Price	Size	Price
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30x3	5.25	36x4	10.50
30x3½	6.50	34x4½	10.95
31x3½	6.80	35x4½	11.20
32x3½	7.35	36x4½	11.75
34x3½	8.00	37x4½	12.20
31x4	8.25	35x5	12.65
32x4	8.75	36x5	13.00
33x4	9.20	37x5	13.45
34x4	9.50	38x5½	13.00

No Punctures; No Blowouts; No Tire Trouble

The above are almost entirely eliminated from these tires.

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One dollar or deposit sufficient to defray express charges required with each order. Shipments sent promptly C. O. D., subject to your inspection.

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Have your old tires
Reclaimed
2000 to 3000 miles more service
Well worth your while

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Chicago, Ill.

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(3,500-Mile Guarantee)

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30x3½.......... 7.50 36x5............ 17.00

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34x4......$6.00

Non-Skid 10% Extra.

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3500 Mile Written Guarantee
Special Dealer Proposition
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furnish our heat-treated piston rings and pistons. First class equipment; 15 years' experience. Write for our prices.

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Mfrs. Eclipse Piston Rings
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fitted with light pistons and LEAKLESS RINGS.

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including new pistons and rings, $7 to $11 per cylinder. General overhauling and repairing.

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Money cheerfully refunded on anything that is unsatisfactory.

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Make New Radiator, allow for old one.
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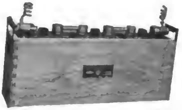

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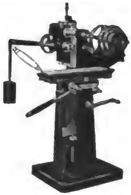

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With the WHITNEY you can handle the work right on the spot. You can avoid delays; you can accommodate customers.

The WHITNEY will measure up to about any milling job you'll be called on to do in the line of auto repairing. With it you can cut gears, sprockets, cams, do key seating, straddle milling, profiling, slotting, slabbing and hundreds of other operations.

Simply drop a postal for Catalog No. 4.

The Whitney Mfg. Co., Hartford, Conn.
Chains—Keys—Hand Milling Machines

Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

Ahlberg Bearing Co. 95
American Ball Bearing Co. 68
American Sheet & Tin Plate Co. 95
Atwater Kent Manufacturing Works 85

B

Bearing Co. of America 85
Beaver Mfg. Co. 85
Bosch Magneto Co. 67
Bossert Co. 82
Bound-Brook Oil-Less Bearing Co. 60
Braender Rubber & Tire Co. 88
Brown-Lipe-Chapin Co. 86

C

Case, T. M Company, J. I. 54-55
Celfor Tool Company 86
Central Steel Company 98
Champion Ignition Co. 78
Cincinnati Storage Battery Co. 96
Columbus Varnish Co., The 79
Combination Rubber Mfg. Co. 85
Contest c/o Glass Journal Co. 52-53
Continental Motor Co. .... Front Cover
Corcoran-Victor Co. 88
Cullman Wheel Co. 95

D

Detroit & Cleveland Nav. Co. 83
Dover Stamping & Mfg. Co. 97
Dyneto Electric Co. 82

E

Eclipse Machine Co. 76
Edmunds & Jones Corp. 87
Eisemann Magneto Company 81
Electric Auto-Lite Co. 87
Electro Metal Products Co. 88
Elkhart Carriage & Motor Car Co. 79
Engineering & Tube Bending Works 95

F

Fahrig Metal Co. 84
Firestone Tire & Rubber Co. 64
Foster Accessories Co., C. H. 78

G

Gibson-Hollister Mfg. Co. 86
G-O Manufacturing Co. 76
Golden-Belknap-Swartz 70
Grossman Co., Emil 95
Gulf Refining Company 80
Gurney Ball Bearing Co. 73

H

Hartford, E. V., Inc. 82
Haynes Automobile Co. 61
Herschell-Spillman Co. 58
Houk Mfg. Co. 87
Hoyt Metal Company 97
Hyatt Roller Bearing Co. 86

I

Indiana Rubber & Insulated Wire Co. 88

J

Johns-Manville Co., H. W. 82
Johnson Company .... Third Cover
Johnson & Sons, S. C. 47

Index to Advertisers

K

K-W Ignition Co. 80
Keystone Vehicle Co. 81
King Motor Car Co. 51
Kissel Motor Car Co. 82

L

Liberty Motor Car Co. 88
Longaker Company, V. A. 65
Lozier Co., H. A. 62-63

M

Mercer Automobile Co. 84
Merrill Spring Co., E. R. 95
Micheln Tire Company 49-50
Milwaukee Machine Tool Co. 85
Moltrup Steel Products Co. 95
Motor Age 88
Motor Products Corp. 75
Motor World 84
Mutty Co., L. J. 80

N

National Rubber Co. 87
Newark Stamping & Foundry Co. 95
New Departure Mfg. Co. 86
New Process Gear Corporation 88
Norma Co. of America 3
N. J. Car Spring & Rubber Co. 86
N. Y. & N. J. Lubricant Co. 82

P

Park Drop Forge Co. 83
Perlman Rim Corp. 84
Pfau Mfg. Co. 83
Pittsfield Spark Coil Co. 74
Prest-O-Lite Co. 85

R

Rajah Auto Supply Co. 84
Rayfield Carbureter Co. 48
Real Valve 85
Regal Motor Car Co. 72
R. & H. Platinum Works 84
Russel Motor Axle Co. 85

S

Salisbury Wheel & Manufacturing Co. 87
Seiss Mfg. Co. 87
Sheldon Axle & Spring Co. 56-57
Simms Magneto Co. 81
Splitdorf Electrical Co. 83
Spring Nut Lock Company 66
Stanley Motor Carriage Co. 59
Stewart-Warner Corp. 2nd Cover
Stromberg Motor Devices Co. 86
Studebaker Corp. 4
Stutz Motor Car Co. 71

T

Tuthill Spring Co. 69

U

U. S. Ball Bearing Co. 77
United Smelting & Aluminum Co. 1

W

Ward Leonard Electric Co. 87
Waukesha Motor Co. 86
Webber & Co., Phil H. 76
Weston Electrical Instrument Co. 84
White & Bagley Co. 2
Whitney Mfg. Co. 96
Willys-Overland Co. Back Cover
Winkley Co. 87

Z

Zenith Carbureter Co. 88

DOVER
INDESTRUCTIBLE
HEADLIGHT BULB CARRIER
FOR
FORD
CARS

The Dover Indestructible Headlight Bulb Carrier solves the problem. It is a round metal container provided with socket at each end which holds the bulbs more securely than in the lamps themselves. Keep it in your tool kit, always ready when needed.
Saves annoyance and prevents accidents in night driving.

DOVER STAMPING & MFG. CO.
CAMBRIDGE, MASS.

PRICE 35¢

Carries 2 Electric Headlight Bulbs

When figuring on die castings or bronze-backed babbitt-lined bearings, remember that we are the largest manufacturers of white metal alloys in the world.

HOYT
Die Castings

Our products are "the dependable kind"—accurate, dense, true to specifications. 35 years' experience in the mixed metal business ensures correct formulae for your special needs.
Send blueprints for quotations on your requirements

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Largest Manufacturers of White Metal Alloys in the World
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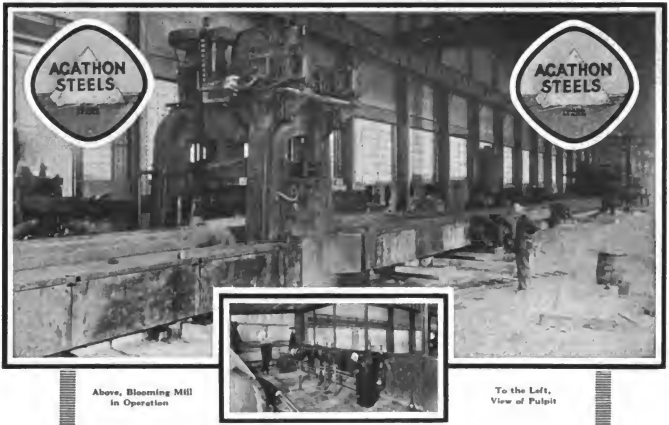
308 Moffatt Bldg., Detroit
Eastern and Lewis Sts., Toronto



Above, Blooming Mill in Operation

To the Left, View of Pulpit

Kneading the Steel like Dough

Just as quality in *bread* depends upon the correct kneading and working of the dough, so quality in STEEL depends upon proper manipulation in the blooming mill. It is the blooming mill that makes the metal tough, homogeneous, dense and fibrous; therefore the blooming mill should be powerful and thoroughly efficient.

Such a blooming mill has been installed in the plant of The Central Steel Company, and is controlled by highly skilled rollers stationed in a pulpit where they can conveniently supervise every detail of the operation.

Our very large capacity guarantees our producing your order of "Agathon" Steel in record time, and the three railroads at our service insure you prompt delivery.

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WILL SERVE YOUR PURPOSE *BEST!*

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"AGATHON" Nickel Steels
"AGATHON" Vanadium
"AGATHON" Chrome Steel
"AGATHON" High Carbon
"AGATHON" Special Analyses

THE CENTRAL STEEL COMPANY

MASSILLON, OHIO

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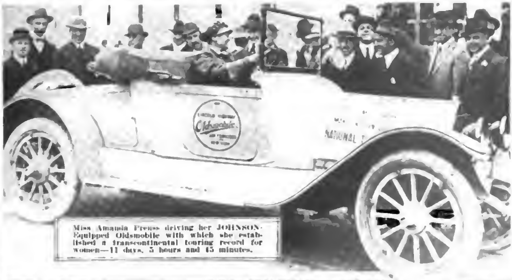


Miss Amanda Preuss driving her JOHNSON-Equipped Oldsmobile with which she established a transcontinental touring record for women—11 days, 5 hours and 45 minutes.

Miss Amanda Preuss at the wheel of her JOHNSON-Equipped Oldsmobile

JOHNSON CARBURETOR

Sets a new Transcontinental Record demonstrating remarkable consistency of performance at all altitudes, all temperatures and under widely varying atmospheric conditions

JOHNSON COMPANY
Makers of Superfine Instruments of Carburetion
Detroit **Michigan**

Go! See! Do! Everything—Everywhere!!

For $635 you can now get this corking car with all kinds of power and speed—and so easy riding that a long day's journey will not tire you.

It has every convenience—it has the looks—will go anywhere any car will go—lots of places other cars can't go—as fast as you want—and with absolute comfort.

Small operating cost—comfort—satisfaction!

These are combined in this car as in no other car the world has ever seen

This wonderful car calls you to a new freedom—a bigger, broader, healthier, happier life for you and your whole family—

And at a cost you can afford.

Its remarkable and sweeping success is due primarily to its wonderful motor—full 31½ horsepower—a whale for work—a thoroughbred for speed.

And because it is so easy riding you can use its speed more freely than you can comfortably drive many a bigger, heavier car costing much more to own and to operate

It has cantilever rear springs and four inch tires—they mean riding comfort and you'll look for this combination in vain in any other car at anywhere near so low a price.

Style—power — speed—comfort — every convenience—

What more can any car give you no matter what you pay?

Orders for these cars are literally pouring in from every part of the world.

See the Overland dealer now and give him your order

The Willys-Overland Company, Toledo, Ohio
"Made in U. S. A."

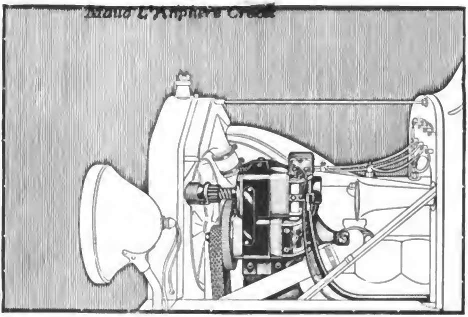
Stanford
SEP 17 1938

The AUTOMOBILE

Vol. XXXV
No. 19

NEW YORK, NOVEMBER 9, 1916

Ten cents a copy
Three dollars a year



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FORD

Brings the conveniences of the high-priced cars to every Ford owner. Quickly installed. Easy to operate. Two units—one for starting and one for lighting, thus adding to reliability and efficiency. Price $75.00, F.O.B. Boston. We have a Distributor covering your territory. Write for his name and send for catalog.

GRAY & DAVIS, Inc. GD Boston, Massachusetts

Editorial Contents—Page 3

Advertisers' Index—Next to last page

STRONGER THAN EVER

Over 95 per cent of the equipped automobiles going into use this coming year will carry the Stewart Speedometer. Be sure it is on your car.

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart
Speedometer

BOWER SAVES POWER

ACCURACY

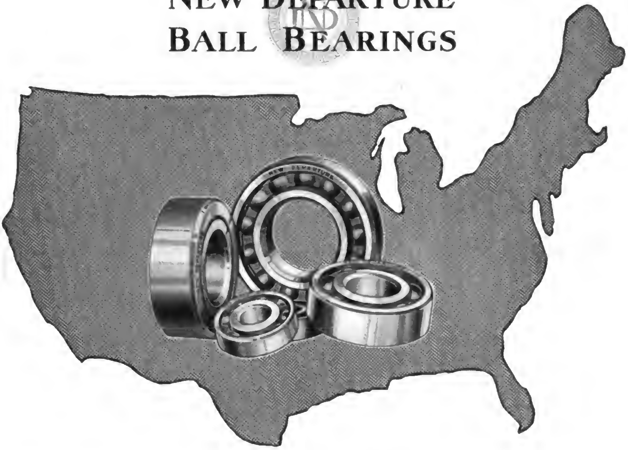
The accuracy of Bower workmanship is so extreme that if Bower rollers were piled up 10,000 high, no two piles would vary as much as a single inch.

BOWER

ROLLER BEARING CO.
Detroit Michigan

Throughout the Country

NEW DEPARTURE BALL BEARINGS



the self-contained, tamper-proof, permanently adjusted units, conquer frictional wear and waste in your motor car mechanism.

Throughout the Country

Internationally standardized New Departures are obtainable in all leading trade centers. New Departure Service extends into every State in the Union.

Fix the New Departure Trade Mark in your mind. Think of it hereafter as indicative of a plant, a product and a service, too apt to be overlooked in the economies they bring. Send for our literature.

THE NEW DEPARTURE MANUFACTURING COMPANY

BRISTOL, CONN., U. S. A.

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Copenhagen, Denmark.

The AUTOMOBILE
THE CLASS JOURNAL COMPANY
231-241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, NOVEMBER 9, 1916 No. 19

Important Trade News of the Week 785-795

Editorials 796

Engines for 1917 a Culmination of Refinement 797

Part II—Mechanical and Thermal Efficiency Increased 801

Part III—Refinements in Structure and Manufacture 803

Specifications of Stock Engine Models for 1917 808

War Develops German Industry 812

Fiat Armored Trucks in Battle Service 814

More News Is Wanted in Advertising 815

Should Use More Female Labor 816

Committees Manage Perfection Spring Co. 819

The Rostrum 821
Data on Mean Effective Pressure
Door Spring as Aid in Assembly
Wiring Diagram of Wagner System
Troubled by Axle Shafts Breaking

Empire 1-Ton Axle Has No Differential 822

Accessories 823

Industrial Miscellany 825

The Automobile Calendar 825

Index to Advertisers 102-103

Steering Gears, Gear Sets and Axles.

These important units are to be completely featured in next week's issue of The Automobile.

The Engineering and Manufacturing phases will be extensively dealt with.

It will be one of the most interesting in the current series of special issues.

Manufacturers are invited to embrace this advantage by using representative advertising space.

Copy should be in our hands not later than Monday morning.

The Class Journal Co.
Publishers
The Automobile
239 West 39th Street
New York City

Why I am a Studebaker Dealer

I AM starting on my fourth year as a Studebaker dealer, and my seventh year as an auto dealer—having had the agency for various lines of cars.

Experience has taught me that a successful dealer is the man who specializes and concentrates on one make of car, and I have selected Studebaker, because first of all the name of Studebaker has, for years, been synonymous with honesty, reliability, quality and progressiveness—all invaluable assets to any dealer.

Secondly, because they have kept their fingers on the public pulse, have always administered to their demands, and can be counted on to produce a "best seller" each year. Thirdly because their business is founded on safe and sound principles which spell "Success" for their dealers as well as for themselves.

CRANSTON & COMPANY

By Earl S Cranston

Boise, Idaho.

"BECAUSE they have kept their fingers on the public pulse." The phrase is worth repeating for it explains one of the chief reasons for Studebaker success.

Ever since the science of efficient motor car building became an institution with Studebaker its aim has been to build what the public wanted and build it well. And you see what the steadfast pursuance of that policy has done for Studebaker.

It has earned world-wide recognition for a make of car that is only equalled in quality of materials and performance records by cars costing hundreds of dollars more. It has earned, for Studebaker, the reputation as being the largest producer of medium priced, quality cars in the world.

If you are a Studebaker dealer you know what a tremendous influence that reputation has on the buyer—and the profit it yields. If you are not a Studebaker dealer, in search of a motor car value that expresses itself equally as well on the road as it does in the showroom—then write to

STUDEBAKER

South Bend, Ind. Detroit, Mich. Walkerville, Ont.

Address all correspondence to Detroit

Studebaker

The AUTOMOBILE

Vol. XXXV New York—Thursday, November 9, 1916—Chicago No. 19

New Co. Takes Over Pierce-Arrow

Pierce-Arrow Motor Car Corp. Formed to Acquire Present Company Stock

New York City, Nov. 8.—The Pierce-Arrow Motor Car Co., Buffalo, N. Y., will be taken over by the Pierce-Arrow Motor Car Corp., which has been formed with 100,000 shares of 8 per cent convertible preferred stock and 250,000 shares of common without par value. A syndicate of New York bankers, headed by J. & W. Seligman & Co., will underwrite the new issues.

The new capital will be used to increase the factory facilities.

George K. Birge, now president of the company, and prominent in the wall-paper business, will retire, and Col. Charles Clifton, now treasurer of the concern and for several years head of the N. A. C. C., will succeed him. Otherwise there will be no change in the organization.

Details of the refinancing plan so far determined provide that the preferred stock will be redeemable at 125, and will be convertible for common on a share-for-share basis. It is also provided that for every dollar in dividends paid on the common stock in excess of $5 a share there shall be set aside $1 for the purchase of the preferred stock. This preferred stock, when acquired, will be exchanged for common, and will be considered available for any stock dividends which may be declared. All of the stock of the existing company will be acquired and arrangements are being made to retire the $1,250,000 of 6 per cent bonds on Feb. 1.

Firestone Capital to Be $15,000,000

Akron, Ohio, Nov. 3—An increase from $4,000,000 to $15,000,000 in the capital of the Firestone Tire & Rubber Co., this city, was authorized yesterday by the stockholders. Two-thirds of this will be preferred and one-third common. Of the preferred, $5,000,000 is to be outstanding for the present. The nominal value of the common stock will be reduced from $100 a share to $10 a share and present shareholders will receive ten shares of new for each share held. Thus $3,000,000 new common will be outstanding. In addition the stockholders authorized the company to sell a maximum of 50,000 shares of new common at not less than $100 a share to employees of every grade. The company will begin dividends on the new common at the rate of $4 a year, which doubles the income of present stockholders. The shareholders authorized the company to set aside $1,000,000 for a fund to be used for insurance of employees, care of dependents, a pension plan, or such other welfare work as the directors shall determine.

The $5,000,000 preferred stock has been underwritten by the Cleveland Trust Co., the price to net the Firestone company par.

Dolbeer Willys-Overland Treasurer

Toledo, Ohio,, Nov. 9—F. K. Dolbeer has succeeded Walter Stewart as treasurer of the Willys-Overland Co. Mr. Dolbeer was formerly with the financial department of the Victor Talking Machine Co. Mr. Stewart continues as a director.

King Raises Car Prices $50

Detroit, Mich., Nov. 6—The King Motor Car Co. has raised the prices of its products. The sedan selling for $1,900 now sells for $1,950 and the seven-passenger touring car and the three-passenger roadster, both of which were $1,350, have been raised to $1,400.

The company announces that there may be an additional increase in the near future, owing to the constantly increasing cost of materials.

Steinmetz's Electric To Be Built

Dey Corp. To Build Lowest-Priced Electric for Utility and Other Uses

New York City, Nov. 8—The low-priced electric utility vehicle which Dr. Charles Steinmetz, engineering authority of the General Electric Co., has been advocating for several years seems near the point of realization. Such a vehicle will be manufactured by the Dey Electric Corp., with offices at 45 Broadway, N. Y. This concern has engaged show space for the Grand Central Palace show, New York, where these new electric vehicles will be on display, and it is planned to have production under way for the 1917 market.

A comprehensive line of what is described as the lightest, lowest-priced and highest efficiency electric vehicle ever built will be manufactured. The Dey company has secured a factory in the Metropolitan zone, and will specialize on a runabout intended primarily for utility work, such as solicitors, etc. The car is not a passenger type, nor yet a truck, but essentially a utility vehicle. In addition to this runabout a closed type of passenger vehicle will be produced. The company will manufacture what might be termed a utility chassis suitable for taxicab purposes, as well as passenger bodies and light truck uses.

That the designs of this lowest-priced electric are practically completed is apparent in that the cars will be at the New York show. That the company will go forward with an interesting manufacturing program is also apparent in that it is strongly financed and presumably closely connected with one of the large electrical manufacturers.

The dream of the $500 electric, as it

(Continued on page 788)

Injunction Holds Up Ford Profits

Dodge Bros., in Suit, Seek to Prevent Investment of Surplus Money

DETROIT, MICH., Nov. 3—A temporary writ of injunction against Henry Ford to restrain the Ford Motor Co. from distributing and investigating as fixed capital assets surplus profits that would otherwise be available for dividends, was issued in the Wayne circuit court yesterday.

The plaintiffs, John F. Dodge and Horace E. Dodge, stockholders in the company and also owners of the Dodge Bros. automobile plant, want the accumulation of cash surplus in the form of special dividends.

The cause of the writ, according to the Dodge bill of complaint, was the declaration by Mr. Ford at the end of the last fiscal year, that no special dividends would be declared in the future by the company and that surplus earnings would be used to extend the business.

The announced policy of Mr. Ford to engage in a multiplicity of undertakings was declared in the bill to be reckless in the extreme and to jeopardize seriously the interests of the stockholders. The bill states that Mr. Ford is engaged in negotiations to invest several million dollars in iron ore mines in Northern Michigan or Minnesota, to build ships transporting ore to smelters and to erect steel manufacturing plants, "thereby depriving stockholders of fair and reasonable returns upon their investment."

Mr. Ford owns 58 per cent of the capital stock of the Ford Motor Co. The authorized capital stock was placed at $2,000,000 in 1908. John F. and Horace E. Dodge each held 1000 shares par value $100 at that time. The Dodge Bros. contend that though the regular monthly dividends—5 per cent, or 60 per cent a year—are large on the $2,000,000 capital stock, the dividends amount to only a fraction of 1 per cent of the capital actually invested when the surplus is taken into account. They also allege that they have been unable to make any arrangements to discuss the plan with Mr. Ford and that he claims that since the profits are to be represented by investments in plants and capital, the stockholders should have no right to complain.

The defendants will be given a hearing to show cause why a permanent injunction should not be granted.

Ford Replies to Charges

The present plans of expansion contemplated by the Ford Motor Co. are only in accordance with the past policies of the company. Dodge Bros. have drawn $5,571,500 in dividends from an investment of $10,000 and still have holdings valued at $50,000,000. Political motives are behind the suit against the Ford company. These are statements by Henry Ford and his attorney Alfred Lucking in their replies to the suit instituted by Dodge Bros.

"At the founding of the Ford business," said Mr. Ford, "Dodge Bros. invested $10,000, but I don't think any of it was in cash. That was in 1903, and since then they have drawn out dividends amounting to a total of $5,571,500 in cash. Of course, they still have a 10 per cent interest in the business that is worth, on their own valuation, $50,000,000. Besides that during the life of the company we have paid them more than $27,000,000 in cash for material and parts made for us, on which I believe they made a profit of at least $10,000,000. It is on the profit of these payments and their dividends drawn from the Ford Motor Co. that their present fortune is built."

Mr. Ford made light of the allegation in the Dodge bill of complaint that his proposed expansion would injure them.

Velie Companies May Consolidate

MOLINE, ILL., Nov. 6.—A special meeting of the stockholders of the Velie Motor Vehicle Co. will be held Nov. 14 at Moline, Ill., to consider a proposition to consolidate with the Velie Engineering Co. under a single corporation under the style Velie Motors Corp., with a capital stock of $2,000,000.

Madison Motors Acquires Anderson Plant

ANDERSON, IND., Nov. 3—The Madison Motors Co., this city, has consummated a deal for the acquisition of the buggy and wagon plant of the Anderson Carriage Co. This plant will be known as the Madison plant No. 2, and is to be used for manufacturing and finishing bodies and tops as well as final assembly. Plant No. 1, the old Rider-Lewis building, later occupied by the Nyberg company, will be used for chassis manufacturing and assembly only. The addition of the Anderson carriage plant gives the company additional floorspace of about 175,000 sq. ft.

Woodard Resigns from N. J. Car Spring

JERSEY CITY, N. J., Nov. 6—S. P. Woodard has resigned from the New Jersey Car Spring & Rubber Co., this city. He has been for the past 2 years general and sales manager of this company. He will not be actively connected with the company in the future.

His immediate plans are uncertain. It is rumored that he is negotiating with a large western tire manufacturer and may handle the entire output of mechanical rubber goods and tires.

United Motors Buys Houk Co.

Ninth Company To Be Taken Over—Management Will Remain Unchanged

BUFFALO, N. Y., Nov. 6—The Houk Mfg. Co., maker of Houk wire wheels, has been purchased by the United Motors Corp., which brings the total number of concerns owned by this corporation up to nine. As with its previous purchases the Houk company will continue as a separate manufacturing organization, and George W. Houk, founder of the Houk company and the one person in the U. S. A. responsible for the present status of wire wheels, will continue as manager.

As with other properties purchased by the United Motors, the Houk Mfg. Co. will be largely increased. There are 500 men at present on the payroll but this number will be increased by 300 at once. Previous to Nov. 1 the capacity was 1000 wheels per day, but it is now up to 2200, and it will be 4500 per day by Feb. 1, according to present plans.

Approximately $1,000,000 will be expended on new buildings and equipment, the work connected with which will be started at once. The capacity of the plant will be doubled.

The progress of the wire wheel in America has been almost entirely connected with the name of George W. Houk. His work in this country started as a licensee of the Rudge-Whitworth company of England. He started manufacture Sept. 23, 1913, and first deliveries were made in February, 1914. To-day the company has an account with eighty-five different car makers, and during the last 12 months has averaged approximatelly 800 wheels per day. The company is at present manufacturing 40 per cent of the wire spokes used in its wheels. The spoke manufacture was started in March, 1915, when Houk purchased the American Spoke and Nipple Co., of Detroit, and moved the factory to Buffalo.

The month of October was the largest month in the history of the company. Total shipments were 19,461 wheels. On Oct. 24 unfilled orders on the books of the company totalled 197,205 wheels.

M. A. M. Annual Banquet Jan. 10

NEW YORK CITY, Nov. 3—The Motor and Accessory Manufacturers will hold their annual banquet at the Waldorf Astoria Hotel, this city, on Jan. 10. W. M. Sweet, former manager and now assistant to the president of the United Motors Corp., has been elected chairman of the banquet committee.

Fisher Body Buys Regal Plant

Also Adding Two Buildings Costing $260,000 and $225,000 —In Operation Next May

DETROIT, MICH., Nov. 2—The Fisher Body Corp. has purchased the factory of the Regal Motor Car Co. located opposite the main Fisher plant here. The Regal unit is already in active operation and with this additional capacity, the Fisher Co., it is stated, is now turning out about 60 per cent of all the closed automobile bodies being made in the United States.

Notwithstanding the increased production the corporation was not able to accept contracts recently offered them to furnish bodies to two of the large producers and therefore is adding to its already extensive plant in Detroit two large buildings, one costing $260,000 for general body construction and one costing $225,000 for service and repair departments, both of which will be in full operation next May.

Charter Oak Car Under Way

HARTFORD, CONN., Nov. 6—The Eastern Motors Syndicate, organized some time ago for the development of a high-grade automobile, has the designing work well advanced and plans are practically completed for construction of a building to meet the manufacturing requirements. The car will be known as the Charter Oak in honor of the city of Hartford, where the famous tree was located. The manufacturing organization will be known as the Eastern Motors, Inc., which will take over the present syndicate and has been incorporated for $1,000,000.

Ricker Heads Ricker Oil Co.

INDIANAPOLIS, IND., Nov. 7—Chester S. Ricker, consulting engineer, was elected president of the Ricker Oil Co., which was recently incorporated at Indianapolis. Associated with him are S. H. Penfield, vice-president of the Sakusvyrt Wheel & Mfg. Co., Jamestown, N. J., and president of the Peru Auto Parts Mfg. Co., Peru, Ind., as vice-president and Robert B. Denham of Indianapolis as treasurer.

Chalmers Motor Corp. Chartered

ALBANY, N. Y., Nov. 3—The Chalmers Motor Corp. formed last week to succeed the Chalmers Motor Co. as a result of the refinancing of the company, has filed articles of incorporation here. The company has 600,000 shares without par value. The directors are Benoni Lockwood, F. A. Gaynor and R. G. Goad, of 43 Cedar Street, New York City.

The Chalmers stock is now on the Curb market, having been offered by J. S. Bache & Co. and C. D. Barney & Co. at $35 a share. Common shareholders, according to the new financing plan, will receive for each share held four shares of the new, while preferred shareholders may have their shares redeemed at $115 or exchange on the redemption basis, about 3½ shares of the new for each share held. The new corporation will keep 135,000 shares in the treasury and use 200,000 shares for exchange purposes. Net proceeds of the 265,000 shares offered, or more than $9,000,000, will go into the treasury.

International Motors Co. Reorganization Plan Is Approved

NEW YORK CITY, Nov. 6—The reorganization plan of the International Motors Co. has been approved by the stockholders and creditors, over 93 per cent of the preferred and 94 per cent of the common being deposited with the two committees. A reorganization plan was adopted in September by which a new company of the same name will be formed to take over the present concern. Additional capital of $1,500,000 was raised and the $2,881,000 notes maturing the first of this month was obliterated.

By this plan the new company's securities will be exchanged on an equal basis for those of the present organization and will consist of $4,381,000 in 7 per cent cumulative first preferred stock, $2,723,000 second preferred and 53,638 shares of common of no par value. Of the first preferred, $2,881,000 is to go to the holders of the notes at par, and the balance will be issued for cash to provide working capital, being offered to stockholders at par with common stock thrown in. Holders of the present $3,600,000 preferred will receive 60 per cent in new second preferred and 10 per cent in new common. For the outstanding $5,628,000 common, 10 per cent in second preferred and 10 per cent in new common is to be exchanged.

Rochette Sails for S. A.

NEW YORK CITY, Nov. 4—Edward Rochette, special representative of the Willys-Overland Co., sailed to-day on the steamer "Pastores" for South America by way of Panama Canal and the West Coast. His destination is Valparaiso, Chile. Mr. Rochette has represented Willys-Overland for some years in the South American field, where he makes headquarters at Buenos Aires.

Winckler with Pittsburg Engine

RACINE, WIS., Nov. 6—A. E. Winckler, formerly chief engineer of the automobile department of the J. I. Case T. M. Co., Racine, has become chief engineer of the Pittsburg Model Engine Co., Pittsburg.

S. K. F. Controls Hess-Bright?

Control of Conrad Ball Bearing Patent License Royalties a Part of Transaction

NEW YORK CITY, Nov. 8—Control of the Hess-Bright Mfg. Co., Philadelphia, Pa., manufacturer of ball bearings, has been secured, it is rumored, by the same financial interests that own the S. K. F. Ball Bearing Co., Hartford, Conn. It is understood that over 50 per cent of the Hess-Bright stock has been secured by the latter concern. No statement has been issued by the S. K. F. company. It is assumed the Hess-Bright factory in Philadelphia will be operated as formerly, and perhaps on an increased scale.

Conrad Patent Included

With the purchase of the Hess-Bright company goes the now celebrated Conrad patent, which was adjudicated in the courts a year ago and which patent has been a valuable asset of the Hess-Bright company. This patent refers to an annular type of bearing in which the balls rotate in a groove presenting a continuous surface. Several bearing concerns have been licensed by Hess-Bright under this patent, these including: New Departure Mfg. Co., Standard Roller Bearing Co. By securing control of the basic patent the S. K. F. Ball Bearing Co. will receive all royalties accruing therefrom. These royalties are a large figure at present and will naturally increase with the greater development of the industry.

Republic Truck Shipments Gain

ALMA, MICH., Nov. 3—Shipments of the Republic Motor Truck Co. in October amounted to 626 trucks, compared with 190 in 1915 and thirty-five in 1914. For the first 10 months of this year the shipments were 4902 trucks, against 1442 in the corresponding period of last year.

Commercial Auto Body Co. Formed

BAY CITY, MICH., Nov. 1—The commercial Auto Body Co., this city, has been formed to manufacture commercial bodies for Fords. The incorporators are W. B. Fitzgerald, Henry Kinney, Robert Woodworth, A. E. Hubbell, Adam Schepper, Edward Covert, W. P. Kavanagh and W. H. Kelly.

Gasco Mfg. Co. Organized

LANCASTER, PA., Nov. 1—The Gasco Mfg. Co. has been formed in this city to manufacture specialties for Fords. R. W. Shreiner is president and general manager. One of the articles to be manufactured is a new cowl dash light for Fords. This company will also put out a new heater for Fords.

Supreme Court Hears Tax Case

Arguments Heard in N. J. Test on Legality of Taxing Non-Residents

WASHINGTON, D. C., Nov. 8—Whether a State can tax an automobilist from another State for the use of its roads will be decided shortly by the United States Supreme Court, the argument for the so-called New Jersey test case prepared by the American Automobile Assn. and the National Automobile Chamber of Commerce having been presented Oct. 31. The case is that of Frank J. Kane against the State of New Jersey, based on his interstate journey from New York to Pennsylvania, which resulted in his being convicted and fined for violating three provisions of the New Jersey law, first that he had failed to register his car in New Jersey; second, that he failed to pay the tax imposed on non-residents; and third, that he failed to file with the Secretary of State a power of attorney.

The American Automobile Assn. was represented by John W. Griggs, former attorney general of the United States, and Charles Thaddeus Terry appeared for the N. A. C. C. The argument presented by them set forth these contentions:

1—It being admitted in the record that the fees charged for the operation of automobiles over the highways of New Jersey result in a large surplus revenue to the State over and above the expenses of examination, licensing, registering and inspecting the automobile traffic on the highways, the charge is a tax which is not in conformity with proper tax laws in that the motor vehicle is burdened with a heavy impost, irrespective of its value, whereas other property is taxed only according to its value.

2—The so-called "license-fee" being in reality a tax, is unreasonable and void as such tax because even assuming that it is a charge for the use of a special facility, to wit—the improved roads furnished by the State of New Jersey, it is unreasonable because a lump sum is charged irrespective of the question how much or to what extent the automobile uses the roads. For example, the same fee is charged for the right of the automobile to go a few hundred yards, as is charged to the automobile which traverses the roads of the State for a whole year covering thousands of miles. Thus the charge is unequal, disproportionate and not upon any scientific or logical basis, and, therefore, improper and illegal.

3—The improved roads of a State are not a "special facility" afforded by the State to automobiles, but their construction and presentation to the public are simply governmental functions which should be paid for out of the general tax fund in the same way that the police force and the fire department are afforded for the use of all the citizens irrespective of the amount of use. Therefore, no special charge or impost can be levied for their use to any particular class of users.

4—That the law is discriminatory and class legislation in that even assuming that the license fee is a charge for the use of the roads, it is not imposed equally upon all the users of the roads. Horse-drawn vehicles use the roads and use up and destroy the roads in a large degree, and, therefore, if the tax were to be an equal and uniform tax, it must be imposed upon horse-drawn vehicles as well as upon automobiles.

5—The requirement that before any non-resident shall use the highways of the State, he must file a power of attorney with the Secretary of State, and authorize such secretary to receive service of process for him, is ousting him of his domicile and imposing a requirement which is not imposed upon any other class of non-resident citizens of the United States going into the State of New Jersey. It is assuming in advance that the automobile user is likely to commit a criminal act which is absurd on the face of it. He is no more likely to commit a criminal act than any other non-resident entering the State of New Jersey, and even if he were, such a method of enforcing the criminal law is unknown to our jurisprudence.

6—The requirement of a power of attorney from non-residents and the imposition of a tax upon non-residents and the requirement that before the highways shall be used by non-residents they shall make application and take out registration, are burdens on interstate commerce which the Constitution of the United States forbids under the Fourteenth Amendment thereof.

It is expected a decision will be rendered by the court before the holiday recess.

Ypsilanti Motor Truck Co. Organized

DETROIT, MICH., Nov. 6—Stockholders of the Globe Motor Truck and Body Co. met Nov. 3 and organized the Ypsilanti Motor Truck Co. with a capitalization of $100,000.

The board of directors includes: H. R. Scoville, Charles N. Haviland, D. L. Davis, F. W. Paton, Frank R. Welsh, H. F. Shaefer and Gilbert E. Porter, all of Ypsilanti. A factory will be built.

Steinmetz Electric To Be Built

(Continued from page 785)

was styled 2 years ago, has been a cherished matter with Dr. Steinmetz. It has been known for several years that he has been perfecting features of design which would make it possible to produce a utility electric vehicle at practically the same price as the cheaper gasoline machines. Dr. Steinmetz strongly advocated this type of vehicle before the different electric interests, as well as before the electric vehicle manufacturers. It was generally considered impossible to build such a vehicle that would give the desired service. The possibility of producing such a vehicle resulted in many strenuous arguments on convention floors, between central station concerns, or companies manufacturing electric current, and those engaged in vehicle manufacture. The central station interests were strong for such a vehicle, as it would naturally be a great source of revenue if manufactured in large quantities. On the other hand, electric vehicle makers were catering to public requirements for larger and more luxurious types of electric vehicles.

The price of the new lowest-priced electric to be built by the Dey corporation has not been determined, but it is understood that it will be under $1,000 and that eventually the dream of Dr. Steinmetz for a $500 vehicle may be attained, if not carried further.

$9,000,000 for Freight Cars by M. C.

DETROIT, Nov. 3.—The Michigan Central Railroad has just closed a contract for the construction of 6750 freight cars, of which 4000 will be cars equipped for carrying automobiles.

Overland Convention in Dec.

Co. Will Be Host to 4000 Dealers of U. S. and Canada

TOLEDO, OHIO, Nov. 4—December is to be the month for the grand welcome to the 4000 Overland dealers of the United States and Canada, and plans are now being formed to make it an epochal month in the history of the big Willys-Overland organization. Beginning about Dec. 4 and ending Dec. 23 there will be a series of gatherings of the Overland dealers here. It is planned to make it the biggest event of its kind ever held in the automobile industry.

Entertainment in Relays

The country is being divided so that the agents from one section will follow those of another every few days until the entire organization has been entertained. Each division will spend about 2 days and 3 nights in the city, and there will be visits to the factory and talks in the new administration building.

President John N. Willys plans to be on hand, so that he may have a chance to talk to all his dealers and give them some word of encouragement for the forthcoming season. At that time he will be ready to announce what the production is going to be, and if there is to be any change in the style of models, prices, etc. From the factory no inkling has been given out as to any proposed announcements, but it would not surprise many of the dealers if new models or new prices were planned, and they were let into the secret just before the big shows, so that they could begin their operations for the new year.

The factory will be the host of the visiting dealers while they are in this city, but the men will pay their own fares to and from their homes. It has been arranged that the dealers will get the benefit of excursion rates.

Kuhn Is Four-Wheel-Drive Tractor

SEATTLE, WASH., Nov. 4—The Kuhn Tractor Truck Co. has been organized here to manufacture a tractor truck, the chief feature of which is that each wheel operates independently of the other. It has a four-wheel drive and power may be applied to all wheels or to each one. There is a positive power control and some of the wheels may be buried in the mud, but the power can be applied to the free wheels alone and no slipping results. The truck is in this way pulled out of difficult positions. A four-wheel brake is another unique feature which equalizes the tension on all wheels at the same time.

127 New Accessory Exhibits

Makes Total of 340—Every Inch of Space Taken—Car Space All Filled

NEW YORK CITY, Nov. 8—The Motor and Accessory Manufacturers, which recently allotted space in the national automobile shows to 115 members, has added 127 concerns not members of the association. With ninety-eight car exhibits, the total reaches 340. Every inch of available space for both the local and Chicago national shows has been allotted. For the first time in the history of the national shows all the space allotted to automobile exhibitors has been filled, and at the first drawing.

The new accessory exhibitors follow:

	New York	Chicago
Acieral Co. of America, New York.	X	X
Adams & Findlay, New York......	X	
Adamson Mfg. Co., East Palestine, Ohio.	X	
J. Alexander Mfg. Co., New York.	X	
American Bureau of Engineering, Inc., Chicago	X	
American Express Co., New York.	X	
Armstrong Cork Co., Pittsburgh..	X	X
Asch & Co., Inc., New York.......	X	
Auto Gear Co., Inc., New York....	X	
Auto Gear & Parts Co., Chicago...		X
Automatic Transmission Co., Inc., New York	X	X
Barnes Foundry Co., Jersey City..	X	
Bausch Machine Tool Co., Springfield, Mass.	X	
Bay State Pump Co., Boston.......	X	X
Becker Bros., Inc., Chicago.........	X	X
Benjamin Electric Mfg. Co., Chicago		X
Bournonville Welding Co., New York.	X	
Brunswick - Balke - Collender Co., New York	X	X
Chalsmith Co., Chicago............	X	X
Class Journal Co., New York......	X	X
Continental Motor Equipment Co., New York	X	
Corcoran Mfg. Co., Cincinnati......	X	
Cox Brass Mfg. Co., Albany........	X	
Craftsman Motor Corp., Chicago...	X	
Crew Levick Co., Philadelphia.....	X	
Culver Stearns Mfg. Co., Worcester, Mass.	X	
Curtis Pneumatic Machinery Co., St. Louis	X	X
Cutler-Hammer Mfg. Co., Milwaukee.	X	
Detroit Battery Co., Detroit.......	X	X
Disco Electric Starter Corp., Detroit.	X	X
Drabek Equalizer Co., Cleveland..	X	
Dunham Piston Ring Co., New York.	X	
Eastern Rubber Co., Philadelphia..	X	X
Essex Rubber Co., Trenton, N. J...	X	
Eureka Rim Compressor, Inc., Addison, N. Y.	X	
J. H. Faw, Inc., New York.........	X	
Fitzgerald Mfg. Co., Torrington, Conn.	X	
Peter A. Frasse & Co., New York.	X	
Fulton Co., Knoxville, Tenn.........	X	X
General Tire & Rubber Co., Akron.	X	
Gibson-Hollister Mfg. Co., Jamaica Plain, Mass.	X	
Gould Compensating Gear Co., Redding, Cal.	X	X
Emil Grossman Mfg. Co., Inc., Brooklyn	X	
H. & D. Co., Goodland, Ind........	X	X
H. & D. Carburetor Co., New York.	X	
Hart-Bell Co., New York...........	X	
Hill Insulating & Mfg. Corp., New York.	X	
G. L. Holmes, New York...........	X	
Holt-Welles Co., Inc., New York...	X	
Hoover Spring Co., San Francisco.	X	X
Hounert Machine Co., New York..	X	
Howe Mfg. Co., Chicago............	X	X
W. H. Howell Co., Geneva, Ill.....		X
Humboldt Machine & Stamping Co., Long Island City, N. Y.	X	X
Humphrey's Sales Corp., New York	X	
Improved Gauge Mfg. Co., Syracuse.	X	
Inland Machine Works, St. Louis..	X	X
International Coat Co., New York.	X	
Interstate Electric Co., New Orleans.	X	X
J. H. Tonneau Shield Co., New York	X	X
Juhasz Carburetor Co., New York..	X	
K-W Ignition Co., Cleveland.......	X	X
Kemco Electric Mfg. Co., Cleveland	X	X
Lane Bros. Co., Poughkeepsie.....	X	X
L. Lawrence & Co., Newark, N. J.		X
Lowe Motor Supplies Co., New York.	X	
McKinnon Dash Co., Buffalo......	X	
McQuay-Norris Mfg. Co., St. Louis.	X	X
Paul M. Marko, Brooklyn, N. Y...	X	
Marvel Accessories Mfg. Co., Cleveland	X	X
Master Spark Co., Chicago.........	X	X
Mattson Rubber Co., Lodi, N. J...	X	
S. Whyle Merritt Co., New York...	X	
Metal Specialties Mfg. Co., Chicago.	X	
Metal Stamping Co., Long Island City, N. Y.	X	X
Charles E. Miller, New York........	X	
Miller Transmission Co., New York.	X	
Moreau & Pratt, Inc., New York...	X	
L. J. Mutty Co., Boston, Mass....	X	
Myle-Mayker Co., Chicago.........	X	X
New Era Spring & Specialty Co., Detroit.	X	X
Packer Auto Specialty Co., New York	X	
Parker Rust Proof Co. of America, Detroit.	X	X
Perkins-Campbell Co., Cincinnati..	X	
N. A. Petry Co., Philadelphia.....	X	
Philadelphia Storage Battery Co., Philadelphia.	X	X
Phillips Auto Seat Cover Co., New York.	X	
A. J. Picard & Co., New York......	X	X
Pittsburgh Electric Specialties Co., New York	X	
Pouvailsmith Corp., Poughkeepsie.	X	X
William E. Pratt Mfg. Co., Chicago	X	X
W. E. Pruden Hardware Co., New York	X	
Reliable Auto Heater Co., Cleveland.	X	X
P. Rielly & Son, Newark, N. J....	X	
Rubber Insulated Metals Corp......	X	X
W. A. Schleit Mfg. Co., Inc., Syracuse	X	X
Scully & Brandt, Inc., New York...	X	
Seaboard Industrial Products Co., New York.	X	
Sipp Machine Co., Paterson, N. J..	X	
Small & Singleton, Brooklyn, N. Y.	X	
Smith Form-A-Truck Co., New York.	X	
Spray Primer Co., Boston..........	X	X
John T. Stanley Co., Inc., New York.	X	
Stentor Electric Mfg. Co., New York	X	
Sternberg & Co., Chicago..........		X
Stevens & Co. New York..........	X	X
F. W. Stewart, Chicago............	X	
Charles O. Tingley & Co., Rahway, N. J.	X	
Tobey Polish Co., Chicago.........		X
Triple Action Spring Co., New York.	X	
Triple Action Spring Co., Chicago..		X
Tuthill Spring Co., Chicago.......		X
United Engine Mfg. Co., Hanover, Pa.	X	X
Universal Motor Products Co., Minneapolis		X
U. S. Air Compressor Co., Cleveland	X	X
U. S. Gauge Co., New York........	X	X
U. S. Metal Goods Co., Cleveland..	X	X
Van Cleef Bros., Chicago..........		X
Wales-Adamson Co., Chicago......		X
Walker Mfg. Co., Racine...........	X	X
Wasson Piston Ring Co., New Brunswick, N. J.	X	
Water Gas Carburetor Co., Kansas City	X	X
Weaver Mfg. Co., Springfield, Mass.	X	X
Westfield Chemical Co., Westfield, Mass.	X	
Weston Electrical Instrument Co., Newark.	X	
C. A. Willey Co., Long Island City, N. Y.	X	
"X" Laboratories, Boston.........	X	X

Brewster & Co. Joins N. A. C. C.

NEW YORK CITY, Nov. 6—Brewster & Co., Long Island City, carriage builder, and which 2 years ago began the making of a car with a Knight engine, has been admitted to membership in the National Automobile Chamber of Commerce.

Time Payment Plan for Trucks

Guaranty Securities Corp. Method Is Similar to Passenger Car Scheme

NEW YORK CITY, Nov. 6—A time-payment plan for truck sales has just been adopted by the Guaranty Securities Corp., which about a year ago entered the field to finance the sale of passenger cars by dealers. The new plan is similar to the passenger car plan, which was described in THE AUTOMOBILE for April 6, but the percentage of cash demanded is not so great because the truck is strictly a necessity and pays for itself.

The status of the Guaranty business may be surmised from its statement that since Jan. 1 it has financed $18,000,000 of passenger car business. The truck plan has been in operation but a few days.

Collects 25% Cash

For a general understanding of the plan it may be stated that when the dealer sells a truck he collects 25 per cent cash from the customer and is paid nearly all the balance by the Guaranty corporation, which collects from the truck buyer through notes. For handling and for adequate insurance a Guaranty charge is made and is paid by the truck buyer. A small part of the sales price of the truck is retained by the Guaranty corporation until the buyer's notes are all paid, but on his deferred payment the dealer gets the prevailing rate of interest.

When a dealer sells a truck of which the f.o.b. factory list is $1,200 the dealer adds freight and the Guaranty charge in arriving at the "Buyer's Delivered Price." This Buyer's Delivered Price is the basis of figuring. It is as shown in the plan outlined in the table on page 795.

Several terms in the plan may require explanation as may also some of the steps.

Delivered Price to the truck buyer consists of the list price of the truck, including body and chassis, the freight from the factory to the dealer and the Guaranty charge. If the truck is an electric the delivered price may include the battery provided the Guaranty corporation approves of the make of battery. This, in effect, means that the battery may be included if it is supplied with the truck as shipped from the factory.

Guaranty Charges are approximately 3 per cent, but for convenience in figuring the prices of trucks have been graded in units of $250 and a flat price arrived at for each class, as is shown by the table of charges on page 795.

(*Continued on page 795*)

120,000 Cars in Canada

Ontario Leads with 50,000—100,000 Cars To Be Produced There in 1917

TORONTO, ONT., Nov. 3—Government registration returns indicate that there are approximately 120,000 cars owned in Canada to-day—an increase in round figures of 45 per cent since a year ago. Ontario with approximately 50,000 cars, maintains her position as the banner automobile province of the Dominion, as in Ontario are owned more than three times the number of cars owned in any other province, and approximately 42 per cent of all the cars in the Dominion.

This large increase in the number of cars in Canada is primarily attributable to two things. The first is, of course, national agrarian, industrial and commercial prosperity, and in the second place to the inauguration in Canada, only now getting under way, of the aggressively progressive intensive car merchandising methods long since successfully in operation in the States.

With every facility to speed this development, Canada has over 400,000,000 acres of fertile wheat land awaiting cultivation—the only great arable tract of land undeveloped in the world under salutary democratic government.

The automobile plants of Ontario will build during the coming year over 100,000 cars, according to their production schedule.

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Pennsylvania Fees for Good Roads?

PHILADELPHIA, PA., Nov. 3—Announcement was made by Governor Brumbaugh, of Pennsylvania, at the opening exercises of the new William Penn Highway at Easton, that a bill would be submitted to the next Legislature providing that all money received by the State from licenses will be turned over to the highway department for new highways. He also announced that the bill would provide for an annual contribution by the State of $5,000,000 for that purpose. The William Penn Highway which was dedicated runs from Pittsburgh to Easton.

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Canada Uses 30 per Cent More Gasoline

KINGSTON, ONT., Nov. 4—According to U. S. Consul Felix S. S. Johnson at Kingston, the consumption of American gasoline in Canada this year has been greater than ever before. To date the amount used is 25 to 30 per cent larger than last year. In the average year the consumption in Canada is about 60,000,000 gal. With an increase of 25 per cent the consumption this year will be about 75,000,000 gal. Throughout the period of high prices gasoline has been cheaper in Ontario than elsewhere.

For the purposes of comparison with Canadian prices the imperial gallon must be used as a basis. This is one-fifth larger than the wine gallon and would bring the American price to 27.6 per gal. To this must be added the duty of 2.5 cents per gallon and freight to the amount of 1.25 cents per gallon. This would bring the cost of Canadian gasoline to 31.35 cents per gallon from tank to garages. The war tax of 7½ per cent is also levied. There are indications that present war prices will go down as a result of poor weather and the increased production of crude oil.

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New Parking Law for Baltimore

BALTIMORE, MD., Nov. 4—Baltimore's new automobile parking law went into effect last week and scores of automobilists were arrested in all parts of the city.

The law requires that no vehicle of any kind be left standing on any streets during the day longer than 2 hr. at a time, nor longer than 3½ hr. at night. The biggest objection raised against the ordinance is that it affects unfrequented streets of the city as well as those on which the traffic is heavy.

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Waukesha Motor Promotes Industrial Education

WAUKESHA, WIS., Nov. 4—A unique plan for the promotion of industrial education has been evolved by the co-operative effort of the Waukesha board of industrial education and the Waukesha Motor Co., motor manufacturer, with the approval of the Wisconsin State board of industrial education. By this plan it will cost the city only a nominal sum for high class instruction, and no investment or upkeep for facilities is required. The Waukesha Motor Co. has permitted the local board to establish a school organization directly within its big plant. The school is open to any person who qualifies by being 16 years of age or over. Part of the time during each day will be devoted to actual teaching and instruction related to the general problem of gas engineering, while the remainder of the day will be devoted to the teaching of citizenship and to diversified employment within the factory itself. Enrollment is open to any young man, whether at present employed by the Waukesha Motor Co. or not, and full wages will be paid for the time devoted to schooling, the same as for employment.

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Pennsylvania License Fees $2,301,240

PHILADELPHIA, PA., Nov. 3—Up to Oct. 30, the Pennsylvania State Highway Department received $2,301,240 in license money. For the entire 12 months of 1915 the amount was $1,650,000.

Mass. Registrations Gain 31,000

113,786 Passenger Cars—17,682 Trucks—8864 Dealers' and Makers' Cars

BOSTON, MASS., Nov. 4—Registration figures in Massachusetts continue to set new records and the Highway Commission has announced that for the first 10 months of this year the relative proportion of increase has been greater than in the past 2 years. Up to Nov. 1 there were 113,786 passenger cars, 17,682 commercial vehicles and 8864 cars belonging to manufacturers and dealers. This gives a total of 140,332 machines. There were 162,046 licenses issued and the receipts have run up now to $1,537,737. These figures exceed expectations. The figures show a gain of some $300,000 in fees over the same time a year ago, and something like 31,000 more cars. The following table gives the comparative figures for the same periods for the past 3 years:

	1916	1915	1914
Automobiles ...	*131,468	†100,500	‡76,146
Manufacturers or dealers....	1,966	1,732	1,514
Licenses, operator and chauffeur ...	55,045	42,325	25,651
Operator and chauffeur renewals	107,001	86,865	70,166
Examinations .	11,179	9,693	.....
Total receipts..	$1,537,237	$1,189,010	$916,712

*Includes 17,682 commercial vehicles.
†Includes 11,564 commercial vehicles.
‡Includes 8,078 commercial vehicles.

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Automobile Telegraphic Code on Market

SAN FRANCISCO, CAL., Nov. 6—The Code Publishing Co. has placed on the market a standardized automobile telegraphic code which is the work of Robert E. Pye. The book has been endorsed by the National Assn. of Automobile Accessory Jobbers, which recommends its use. The code is divided into three divisions: Merchandise, in which is coded supplies, accessories and car models; general phrases, covering orders, shipping, prices, general communications, etc.; the third division is tables of measurements, money, transportation, etc. The book will be distributed by Commissioner W. M. Webster of the N. A. A. A. J., Chicago.

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Engel to Promote Oldsmobile Sales

LANSING, MICH., Nov. 6—J. W. Engel has been appointed manager of the sales promotion department of the Olds Motor Works. Before entering the automobile field Mr. Engel was in newspaper work and for several years filled an executive position with the U. S. Postal Service.

Para Needs More Good Roads

Gaidzik, Representing Nash in S. A., Finds Little Future Without Them

NEW YORK CITY, Nov. 4—George W. Gaidzik, South American representative of the Nash Motors Co., arrived in this city yesterday after a 10 months' business trip along the East Coast of South America, where he has been establishing agencies and demonstrating the Jeffery Quad and the Jeffery passenger car. During his recent trip Mr. Gaidzik has spent most of his time in Buenos Aires, Montevideo, Sao Paulo, Rio de Janeiro, Bahia, Pernambuco, and the two Amazon cities, Para and Manaos. Speaking of the present possibilities of automobiles in the Amazon valley, Mr. Gaidzik does not look for a big future of either of the cities of Para or Manaos. From 5 to 10 years and perhaps more may be necessary to get the road-building movement started. Para, near the mouth of the Amazon, is a city of 150,000 with 200 automobiles. Of these seventy-five are privately owned vehicles, and the remainder are in taxi service. Motor trucks have made little progress in this city, there being only five trucks most of which are used in the brewery industry. To these must be added delivery wagons used by the large stores, which are not very numerous.

As in the majority of South American cities, the streets of Para are well paved with stone block, a good surface for motor use. The trolley tracks are, however, used almost exclusively. Cars for this city should have right-hand steering, although left-hand will do. The rules of the road in Para are the same as in the U. S. A. The 56-in. tread is satisfactory.

Manaos a Rubber City

Once the streets of Para are left there are no roads with the exception of dirt trails in the immediate outskirts of the city. The country is fairly level but generally covered with forest. There being little cultivation surrounding the city there is naturally no market for cars outside of the city limits.

The city of Manaos, like Para, is essentially a rubber city, but located well up the Amazon. With a population of over 100,000 there are about 100 automobiles in the city, a quarter of which are in use. To these must be added three or four motor trucks in the service of breweries and ice companies. You can use an automobile on the streets of the city and on the outskirts but once you are beyond these, the forest begins and all use of a car ends. The city streets in Manaos are paved with stone blocks as in Para.

In both of these rubber cities of the Amazon, the odor of crude rubber is omnipresent. There is a constant teaming of it in the city from dock to warehouse. Both cities are well provided with hotel accommodations. In Para there is a five-story hotel which ranks with any in South America. It is being added to at the present time. The hotel accommodations at Manaos, while not so extensive, are quite satisfactory.

The population in both of these rubber cities is largely Portuguese. There is a good sprinkling of English. All of the poorer classes are black.

Automobile imports in these Amazon River cities, according to figures from the Brazilian government, are as follows:

Port	1910	1911	1912	1913	1914	1915
Manaos	32	31	29	24	5	0
Para	72	76	61	58	14	0

Security Co. to Finance Dealers

ST. PAUL, MINN., Nov. 2—The Security Mortgage Co., this city, has been formed with a capital of $1,000,000 to finance automobile and truck sales here. It has taken headquarters in the New York Life Building and will begin business at once. G. N. Michaud will be in charge of the office.

J. N. Storr, president of Kuhles & Stock Co. is president; A. Hirschman, vice-president of the People's Bank, is vice-president; N. P. Rogers of Rogers & Rogers, live stock dealers, is treasurer and G. N. Michaud, secretary and general manager.

Two New Jeffery Sedans

KENOSHA, WIS., Nov. 6—The Nash Motors Co., this city, has brought out two new Jeffery sedans in four- and six-cylinder seven-passenger types, the tops being removable for summer touring. The large French plate windows drop 5 in. for ventilation in warm weather, the rear window measuring 19½ by 31 in. Divided front seats eliminate the necessity of fore doors and thus do away with the need for a panel between the front window and the rear door. Upholstery is gray whipcord and there are roll curtains on the windows.

Cassidy Handling Corning Conaphore

NEW YORK CITY, Nov. 6—The Corning Glass Works, Corning, N. Y., has appointed the Edward A. Cassidy Co. as sales division for the Corning Conaphore, a new device for giving the right direction and long range to automobile headlights, and for eliminating glare. It is made in white glass and patented Noviol yellow tint glass, which eliminates the violet-blue rays, enabling the light to penetrate fog and dust and does away with back glare.

Canadian Farmers Prosperous

High Price of Wheat Stimulates Sale of Automobiles to Rural Population

TORONTO, ONT., Nov. 3—Using the wheat quotations of the week as a barometer, the automobile manufacturers who sell machines to the farmers of western Canada find the outlook most gratifying. December wheat was quoted at $1.90 last week, nearly twice the figure of some seasons. Canada's war crop of wheat is yielding handsome profits to the farmers, which leads W. P. Hinton, traffic manager of the Grand Trunk Pacific Railway, to measure prosperity in terms of automobiles owned, and cars bought, in the present year.

"Farmers are exceedingly prosperous," he states, "and their purchasing power was never so great."

"Perhaps a striking illustration of this fact," declares the railroad man, "is that approximately $2,000,000 more than in any other year has been expended by the rural population in the purchase of automobiles. In fact, the automobile seems to have become a farm necessity, and even if we are disposed to consider it an extravagance, it certainly adds to the joy of living in the agricultural districts of Canada."

Racine Tire Branch Managers Meet

RACINE, WIS., Nov. 4—The Racine Auto Tire Co., this city, which already has announced plans for a new plant involving $100,000 or more, entertained its branch managers and salesmen at a convention at the present factory for two days last week. The policies of the company and plans for the disposition of the 1917 output were discussed. Managers of the branches at Chicago, Milwaukee, Minneapolis and Des Moines were present.

Selden Division Managers in Conference

ROCHESTER, N. Y., Nov. 6—The first conference of division sales managers and prospective division managers of the Selden Truck Sales Co., this city, under the regime of Sales Director H. T. Boulden, was held Nov. 2, 3 and 4.

Mr. Boulden presided, being assisted by President Geo. C. Gordon, Vice-President Wm. C. Barry, Jr., and Secretary R. H. Salmons.

Representatives in attendance were George S. Holvey, home office sales department; E. W. Templin, Chas. N. Gillette, Southeastern representative; Chas. E. Collard, Atlantic Coast representative; Wm. C. Barry, Jr., general manager, Selden Motor Vehicle Co.; Edward F. Drew, Middle West representative; Paul B. Donaldson, Northwest representative; W. E. Dugan, factory manager; H. T. Boulden, sales director; J. E. Morse, New England representative; C. L. Du Puy, Southwestern representative; S. P. Gould, Rochester, and D. S. Everett, Pacific Coast representative.

Anderson Sales Gain 141 Per Cent

Car Shipments for 4 Months Increase 79 Per Cent Over 1915 Period

DETROIT, Nov. 4.—The Anderson Electric Car Co. had an increase in business amounting to 141 per cent during its fiscal year. Car shipments for 4 months of the current year have been 79 per cent greater than for a similar period in 1915, and it is expected that the company's business for the current year will be 100 per cent greater than last year. Directors elected are: W. C. Anderson, M. S. Towson, J. B. Book, Jr., G. M. Bacon, G. D. Fairgrieve, W. M. Locke, W. P. McFarlane, W. H. Murphy, F. E. Price. The directors elected officers as follows: W. C. Anderson, president; M. S. Towson, vice-president; G. D. Fairgrieve, vice-president and assistant treasurer; W. P. McFarlane, secretary and factory manager; W. M. Locke, treasurer; F. E. Price, assistant treasurer; Wilson Oritzer, assistant secretary.

Studebaker Earns $8,140,420

DETROIT, Nov. 3.—The Studebaker Corp. reports net profits for the 9 months ending Sept. 30 amounting to $8,140,420. The net profits for the same period in 1915 were $7,082,479.

Practically all of the net profits this year were from domestic business, as total net profits from war orders were $154,000, as compared with $3,140,000 realized on war orders last year.

70 Per Cent of Gasoline Pumps Tested Found Inaccurate

WASHINGTON, D. C., Nov. 6—The Bureau of Standards has in circulation report No. 81 on liquid measuring-pumps for selling gasoline. The report, in addition to a description of the different systems, gives results of some inspections having to do with the accuracy of these pumps.

Of seventy-nine measuring systems of various types chosen at random and tested in a number of different cities, fifty-five, or 70 per cent, had errors in excess of the tolerance allowable, and twenty-four, or 30 per cent, had errors within the tolerance. In addition, there were eight outfits so constructed as to be absolutely unsuited for retail liquid dispensing.

Of the fifty-five out of tolerance 80 per cent gave deliveries in deficiency and 20 per cent in excess. This tendency toward deficient measurement is worthy of careful consideration, and it is only proper to call attention to the fact that most of the causes of error in measuring-pump operation tend toward the side of deficient delivery. Among these may be mentioned leaks, retention of liquid by the hose. excessive virtual suction head, resulting in vaporization and other losses, failure to complete the full stroke and slippage.

Templars Motors Corp. Formed

CLEVELAND, Nov. 3.—The Templars Motors Corp. has been formed, and will manufacture a four-passenger roadster at $1,250, a five-passenger touring car at $1,250, a five-passenger sedan at $1,850, and a two-passenger roadster at $1,225.

Materials Markets Steady

NEW YORK CITY, Nov. 8—The automobile materials' market was steady last week, very few price changes taking place. Steel, copper, aluminum, and lead, remained constant. Ceylon rubber was 3 cents higher per pound, reaching 60. Tin rose to $42.33 1/3 per 100 lb., a net rise of 45 cents. Cottonseed oil declined 60 cents per barrel to $11.80. The rest of the materials were unchanged and steady, as shown in the accompanying tabulation.

It is estimated that 80 per cent of the copper production for the first 6 months of 1917 has been sold, indicating that approximately 900,000,000 lb. of copper have been placed on the producers' books for delivery during the period from Jan. 1 to June 30 next.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge.
Aluminum, lb.	.65	.65	.65	.65	.65	...
Antimony, lb.	.13	.13	.13	.13	.13	...
Beams and Channels, 100 lb.	2.96	2.96	2.96	2.96	2.96	...
Bessemer Steel, ton	50.00	50.00	50.00	50.00	50.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	12.40	12.35	12.22	12.10	11.80	— .60
Fish Oil, Manhaden, Brown, gal.	.60	.60	.60	.60	.60	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.25	1.25	1.25	1.25	1.25	...
Lead, 100 lb.	7.02½	7.02½	7.02½	7.02½	7.02½	...
Linseed Oil, gal.	.90	.90	.90	.90	.90	...
Open-Hearth Steel, ton	50.00	50.00	50.00	50.00	50.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.83	.83	.83	.83	.83	...
Rubber, Ceylon, First Latex, lb.	.57	.57	.58	.58½	.60	+ .03
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	41.87½	41.75	41.75	42.12½	42.33⅓	+ 45
Tire Scrap, gal.	.06½	06½	.06½	.06½	.06½	...

Security Prices Are Higher

Tire Issues Strong—Much Buying on Margin—Further Rise Expected

NEW YORK CITY, Nov. 8—The usual heavy buying and selling before Election Day occurred on Monday. The market was mostly bullish, the majority of buyers predicting a rise after Election Day. As a result of this heavy buying prices of many issues rose. Much pressure was brought to bear on Ajax Rubber and United Motors, which went up 3⅞ and 2 points, respectively. General Motors, Chalmers, Firestone and Kelly-Springfield Tire, were also in demand.

General Motors common rose 10 points as did Chalmers. Chalmers preferred rose 7 points, one of the features of the week. This company announced a refinancing plan last week. Firestone Tire common rose 5 points to 1150, a record price. Kelly-Springfield Tire common rose 2½ points to 77½.

Hayes Wheel Co. Add $500,000

JACKSON, MICH., Nov. 6—The Haynes Wheel Co., this city, has increased its capitalization from $1,000,000 to $1,500,000. The increased fund will be used for additional machinery and equipment for the manufacture of wire wheels.

Newell Purchasing Agent for Hood

DETROIT, MICH., Nov. 3—R. B. Newell has joined the staff of the Wallace Hood Service Bureau as the purchasing agent. Mr. Newell was formerly connected with the Briggs Detroiter Co. as service manager.

Bate Predicts Higher Material Prices

DALLAS, TEX., Nov. 6—That automobile makers of the North and East are expecting an advance in materials that may result in higher cost of automobiles, was the statement expressed by John W. Bate, vice-president and chief engineer of the Mitchell Motors Co., in an address before Texas Mitchell dealers at Dallas last week. The address was given at a dinner tendered by H. T. Hays, district representative for the Mitchell company at the Adolphus Hotel. Other factory representatives who spoke at the meeting were: George W. Hipple, general merchandising counsel and F. W. Pelton, advertising manager.

Avery Tractor Maker's Capital $2,300,000

LOUISVILLE, KY., Nov. 3—B. F. Avery & Sons, manufacturers of gasoline tractors in this city, have filed amended articles of incorporation fixing the capital stock at $2,300,000, against the old capitalization of $1,500,000. The $200,000 of 7 per cent series A preferred will be retired and a series known as A1 preferred, consisting of 7000 shares at $100, bearing 7 per cent, will be issued; another series of $600,000 preferred, paying 6 per cent, will be put out. There is a similar issue outstanding. There will be 10,000 shares of common of $100 each, as compared with 700,000 authorized at present.

S. R. B. Earnings Halt Reorganization

PHILADELPHIA, PA., Nov. 3—The earnings of the Standard Roller Bearing Co. during the past year have shown so much improvement that the proposed reorganization of the company, it is stated, has been practically abandoned. Net earnings for the year ended Sept. 30 last were $747,546.

There are outstanding $2,725,850 common, $572,750 7 per cent cumulative preferred of authorized issues of $4,000,000 common, $3,000,000 first preferred and $1,000,000 second preferred stock.

Fisk Ratifies Increase of Capital

CHICOPEE FALLS, MASS., Nov. 1—The Fisk Rubber Co., this city, has approved the increase in capital from $19,400,000 to $39,500,000 and extension of time for conversion of second preferred to common stock from Nov. 1, 1917 to Nov. 1, 1932.

Packard Continues Expansion

Many New Buildings—Numerous Machines Installed—Sociological Work

DETROIT, MICH., Oct. 27—Fourteen months ago the Packard Motor Car Co. ordered a bird's-eye view made of its plant. When it was finished it was found to be old compared with the number of buildings added after the photograph was taken. The company has endeavored three times since to secure a bird's-eye view, but always with the same result. The building construction has been so rapid and vast that each view is always one or two stories or buildings behind. It is quite likely that the view shown here, though finished as the story is written, will not include the structures that have been started or completed in the past few days. Demands for increased productive facilities have been so urgent that construction of new buildings cannot catch up with it.

During the past year, 6.6 acres of floorspace have been completed while 4 acres are under course of construction, making a total space of 58.2 acres of floorspace that the company will utilize for the manufacture of its products. The buildings completed recently cost $1,000,000 and those in the course of erection amount to $350,000. The company will have a total of sixty-six buildings when all plans for immediate construction are finished. Those recently completed and under course of construction include a traffic garage, 54.9 by 183 ft., two six-story additions to the stock room building, each 103 by 200 ft., a power house addition four stories high, 65 by 140 ft., two four-story additions, each 60 by 396 ft., a lumber storage shed 50 by 140 ft., a truck storage building, 36 by 272 ft., and a heat treating plant four stories high and 60 by 130 ft. There will be a total of 2,553,272 sq. ft. of floorspace when all structures in course of erection are completed, divided into four divisions: main division, 1,792,061 sq. ft., service division, 216,087 sq. ft., truck division, 346,292 sq. ft., and the forge and foundry division which serves both trucks and pleasure cars and will have 198,380 sq. ft.

5530 Major Machines

There are 5530 pieces of major machinery in the factory of which 550 were recently installed including the following among the more important:

Toledo press, cost $8,000, which has a pressure capacity of 250 tons and is used to stamp sheet metal into running boards, bonnet sides, fenders, etc., and which is almost as large as one side of the building it occupies.

A flywheel machine that performs all finishing operations on the raw flywheel casting in 11 min.

Two worm bevel gear wheels and worm bevel pinion cutters that cut to 0.001 in., and which cost $3,000 each.

A milling machine, cost $6,275, that mills the rough off the cylinder blocks

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	70	73	+3⅞
J. I. Case T. M. Co. pfd	83	85	—3
Chalmers Motor Co. com	125	140	+10
Chalmers Motor Co. pfd	105	115	+7
*Chandler Motor Car Co	105	105½	+1
Chevrolet Motor Co.	186	190	..
Fisher Body Corp	39	42	+1
Fisk Rubber Co. com	..	93	..
Fisk Rubber Co. 1st pfd	109	113	+1
Fisk Rubber Co. 2d pfd	95	105	—5
Firestone Tire & Rubber Co. com	1150	1170	+5
Firestone Tire & Rubber Co. pfd	104	106	—6
*General Motors Co. com	810	875	+10
*General Motors Co. pfd	124	126	—2
*B. F. Goodrich Co. com	71⅛	71⅝	—1⅛
*B. F. Goodrich Co. pfd	112	114	..
Goodyear Tire & Rubber Co. com	293	296	—3
Goodyear Tire Rubber Co. pfd	108¼	109½	+ ¼
Grant Motor Car Corp	8	10	..
Hupp Motor Car Corp. com	5⅛	6	..
Hupp Motor Car Corp. pfd	92	100	..
International Motor Co. com	4	8	—1
International Motor Co. pfd	20	30	..
*Kelly-Springfield Tire Co. com	77½	78	+2½
*Kelly-Springfield Tire Co. 1st pfd	97	100	..
*Lee Rubber & Tire Corp	41½	41½	+1
*Maxwell Motor Co. com	84½	84⅞	—1
*Maxwell Motor Co. 1st pfd	85	86	— ½
*Maxwell Motor Co. 2d pfd	54	54½	—1
Miller Rubber Co. com	240	260	..
Miller Rubber Co. pfd	105	107	..
Packard Motor Car Co. com	..	175	..
Packard Motor Car Co. pfd	93	99	—1
Paige-Detroit Motor Car Co	38	39	—4
Peerless Truck & Motor Corp	23	25	+1
Portage Rubber Co. com	170	173	..
Portage Rubber Co. pfd	170	173	..
Regal Motor Car Co. pfd	20	30	+3
†Reo Motor Car Co	46	48	..
Saxon Motor Car Corp	77	79	— ½
Springfield Body Corp. com	95	100	..
Springfield Body Corp. pfd	120	130	..
Standard Motor Construction Co.	7	9	— ½
Stewart Warner Speed. Corp. com	110½	112½	—1
Stewart Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	128⅛	129	+1⅛
*Studebaker Corp. pfd	111½	112	+1
Swinehart Tire & Rubber Co.	90	92	..
United Motors Corp	64½	64⅞	+2
*U. S Rubber Co. com	60¾	61⅛	+1¾
*U. S. Rubber Co. pfd	110	111	..
White Motor Co.	55⅛	56	+1⅛
*Willys-Overland Co. com	42½	42⅞	+ ⅛
*Willys-Overland Co. pfd	103	104	+ ½

*At close Nov. 4, 1916; listed New York Stock Exchange. †Par value $10; others $100.

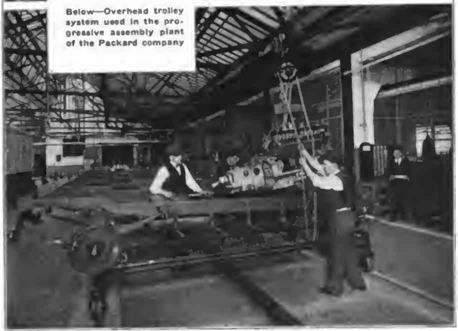
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	42½	44½	— ⅛
Chalmers Motor Co. com	124	130	+4
Chalmers Motor Co. pfd	..	..	..
Continental Motor Co. com	37½	38⅛	— ⅜
Continental Motor Co. pfd	9½	10¼	..
Ford Motor Co. of Canada	..	300	..
General Motors Co. com	790	850	—10
General Motors Co. pfd	124	127	— ½
Maxwell Motor Co. com	83½	86	—3½
Maxwell Motor Co. 1st pfd	84	86½	—1½
Maxwell Motor Co. 2nd pfd	52½	55½	—1½
Packard Motor Car Co. com	..	170	..
Packard Motor Car Co. pfd	100	102	..
Paige-Detroit Motor Car Co	38	40	—3
W. K. Prudden Co.	49¼	50½	+ ¼
Reo Motor Car Co.	45½	46⅛	— ½
Studebaker Corp. com	126½	129½	—5½
Studebaker Corp. pfd	109	..	..
C. M. Hall Lamp Co.	..	31	..
INACTIVE STOCKS			
Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd	20	..	+2

Above—Showing the constant building in which the Packard company is now engaged



Below—Overhead trolley system used in the progressive assembly plant of the Packard company

Two of the recent additions used for progressive assembly work

and reams it in consecutive operations in 6.7 min.

Two smaller milling machines of the same nature as the one above.

A cylinder boring machine that bores out rough cylinder blocks, and mills it by a progressive revolving operation.

Eight multiple drills costing $3,000 each and capable of drilling 156 different holes in the crankcase and cylinder blocks in 28 min.

One multiple drill that bores forty-seven holes in the transmission case in one operation.

Two hydraulic presses that force the rear axle housing onto the tube and have a pressure of 20 tons to the square inch. Each of these machines takes a floor-space 10 by 30 ft.

Two special Packard machines that dome the inside of cylinder blocks and which were designed, invented and built in the Packard factory.

Progressive Assembly

The plant operates upon the progressive assembly and manufacturing system based upon six divisions arranged as:

(*a*) Progressive machinery.
(*b*) Progressive stock conveying.
(*c*) Progressive chassis erection.
(*d*) Progressive motor assembly.
(*e*) Progressive enameling.
(*f*) Progressive final assembly.

The stock conveying mechanism was recently finished for the assembly of rear axles and transmissions at a cost of $35,000.

The final assembly is conducted in one of the new buildings that parallels the stockrooms and is so situated that the bins can be loaded with fifty car lots of various stocks at one time and the workers are never forced to move more than 7 ft. from the stock supply. Both floor and overhead trolley conveyors are in use. The bodies are lowered on to the chassis by means of the overhead system.

New ovens, 126 ft. long, have been installed in the enameling rooms and are capable of 400 to 500 deg. of heat. Two huge tanks holding 1860 gal. are utilized to clarify the enamel and a mechanical washing machine was recently added that contains 250 bbl. of water and is used to secure and cleanse all parts before they are enameled.

12,000 Employees

The company employs 12,000 men and plans to use 15,000 when the buildings now being erected are completed. It does much for its employees to uplift them in their homes, business and social life and has commenced several schools besides erecting a clubhouse and baseball ground.

The school includes courses for salesmen, truck manufacture and motor work, and also the teaching of English to foreigners.

Guaranty Securities Corp. To Finance Truck Sales

(*Continued from page* 789)

There are two charges, Charge A and Charge B. Charge A applies to all trucks below $1,500 and Charge B must be applied to all above $1,500. Charge B may be applied to those below $1,500. Charge B is the addition of a flat $30.50 to Charge A to cover collision insurance, and in case the service is such that collision is at all probable the dealer may insist upon the buyer paying Charge B where Charge A might otherwise prevail.

Above $1,500 the Charge B is 5 per cent of the delivered price.

These two charges are made because the collision risk is considered greater on the heavier trucks. Rather than base the charge on weights it was deemed more satisfactory to base the dividing line on price, the corporation believing that $1,500 is a good mark between heavy and lighter vehicles.

In case trucks are going into such a rush-and-hurry service as mail delivery, and if the price is below $1,500, the collision risk is greater, and in that case Charge B would apply below $1,500.

Charge A, as does Charge B, includes the usual fire and theft insurance and covers the cost of handling the deal. The insurance becomes effective as soon as the contract is signed and the truck delivered.

The dealer determines whether Charge A or B is to be made.

In case the dealer takes a car or truck in trade the allowance made must be included in the 25 per cent cash payment that he secures when the new truck is delivered. The Guaranty corporation will not finance the sale of used trucks.

If a buyer wishes he may pay more than 25 per cent down and may make the term of payment less than one year—but not more. Dealers are encouraged to get as much down as possible and as short a payment term as possible.

The interest on the notes and the Deferred Certificate must not exceed the prevailing legal rate. In most States this is 6 per cent, wherefore 6 per cent has been used in the table at the beginning of this story.

After the dealer has secured the 25 per cent cash payment he enters into a conditional sale contract with the buyer. This form is laid out in a very simple way. Under each blank space to be filled in is a small number. On the first page of the contract is told what these numbers mean, so that the dealer may always know just how to make out the contract. For instance, under one blank space it says "7." The first page of the contract says: "7, the amount of the note." So, where it says "7" the dealer writes in the amount of the note.

Handling the note is made simple. The note is attached to the first page of the contract. All the dealer has to do is fill in the blank space as explained by the numbers, there even being directions as to where the buyer's name shall go. It is difficult for a dealer to go wrong in filling out this contract and note.

Having the contract and note signed, the dealer forwards them to the Guaranty Securities Corp. and in a few days receives 90 per cent of the face of the note in cash. He then has 25 per cent of the whole and 90 per cent of the 75 per cent balance, which amounts to 92½ per cent of the whole price of the truck, including freight.

For the remaining 7½ per cent the dealer has to wait until the buyer makes the last payment, but this is represented by a Deferred Certificate, upon which he receives interest at the same rate the note itself carries.

The dealer has nothing whatever to do with making collections, and the buyer deals only with the securities corporation. Local banks are not involved.

One other little job the dealer has to do is have the buyer fill out a Purchaser's Statement. Statement A is used in case the buyer is worth more than $5,000 and Statement B if he is worth less.

Matters are still further simplified for the dealer by the attachment to the contracts, which are in duplicate, of a printed letter form. This is filled out by the dealer and mailed with the note and contract to the Guaranty corporation.

Advantages to the dealer are: He can

Extend his business without increasing his capital.

Secure sales where cash-buying might stand in the way.

Get all his cost and nearly all his profit at the time of sale.

The buyer:

Gets his truck at once and pays for it while he is using it.

Does not have to have credit handled through local bank.

Notes are held in trust, not hawked about.

THE DEALER'S PART.

1—Collects 25 per cent of $1,312 in cash, which includes the $67.50 that goes to the Guaranty Securities Corporation	$328.00
2—Sends to Guaranty Securities Corporation note for the balance of 75 per cent	984.00
3—Receives at once 90 per cent of face of note, deducting $67.50, which was received by dealer for Guaranty Securities Corporation's charge	818.10
4—Dealer has received in cash at once	$1,146.10
5—Receives Deferred Certificate for 10 per cent of $984, bearing interest at 6 per cent...$98.40	
6—When last payment is made he gets the $98.40	98.40
List price of truck plus freight	$1,244.50
7—Dealer also receives 6 per cent interest on the $98.40 Deferred Certificate	5.90
Dealer actually receives for truck	$1,250.40

THE BUYER'S PART.

1—Pays cash 25 per cent of $1,312	$328.00
2—Signs conditional sale contract and note for balance of ...$984.00	
3—Pays $82 monthly for 1 year	984.00
Delivered price of truck	$1,312.00
4—Also pays interest on the note	31.98
Buyer actually pays for truck	$1,343.98
Price of truck plus freight	1,244.50
Cost of accommodation	99.48
Cost of accommodation per month	8.29
" " " per week.	1.91
" " " per day.	.32

GUARANTY SECURITIES CORPORATION'S PART.

1—Accepts from dealer the buyer's note for	$984.00
2—Advances to dealer at once 90 per cent of $984 minus the $67.50 Guaranty charge	818.10
3—Collects $984 from buyer in 12 monthly payments.	
4—When last payment is collected pays dealer Deferred Certificate of $98.40, plus interest at 6 per cent.	104.30
5—Company realizes as follows:	
a—Guaranty charge ...$67.50	
b—Interest from buyer... 31.98	
Total ...$99.48	

Guaranty Plan for Selling Trucks on Time

Illustrating by a truck listing at $1,200 and on which the freight is $44.50. The interest rate is assumed to be 6%. The plan is based upon the Delivered Price, which is arrived at as follows:

Factory list price, f.o.b., chassis and body	$1200.00
Freight	44.50
Price the dealer must get for himself	1244.50
Guaranty Securities Corporation's charge	67.50
CUSTOMER'S DELIVERED PRICE. What the buyer must pay	1312.00

CHARGE A

May apply up to $1,500 Job. Includes incidentals and usual fire and theft insurance for one full year.

CHARGE B

May apply up to $1,500 Job—Required on trucks selling for more than $1,500. Includes incidentals and usual fire, theft and collision insurance for one full year.

GUARANTY CHARGES

$14.50	On all trucks between	$500 and less	$45.00
22.00	" " "	501 " $750	52.50
29.50	" " "	751 " 1,000	60.00
37.00	" " "	1,001 " 1,250	67.50
44.50	" " "	1,251 " 1,500	75.00
Must pay CHARGE B on all trucks		1,501 or more	5% of delivered price

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Engine Development

POWER plant improvement is a major development in the industry. Every demand made upon the car is reflected in the engine. The automobile-buying public has been educated to the point where the engine demands are in excess of what the nature of the fuel would suggest as being feasible, and the matter has developed itself into a contest between the possibilities of the fuel and of super-development in the methods of vaporizing it and burning it.

The path for future progress is fairly clear. There is little doubt regarding the way in which design must travel if it is to continue to progress. Better vaporization of the heavier fuel, increased volumetric efficiency, or in a word, the increase of mean effective pressures by improvements in design which will tend to get the gas into the cylinder in a condition best suited for rapid combustion and with the least possible friction due to restrictions and bends in the ports.

Lighter reciprocating parts are a necessary development due to other improvements which have permitted higher speeds. With the power plants of a few years ago where the maximum piston speed was 1000 ft. per min. for passenger vehicles, it was not necessary to be so very careful regarding reciprocating weights and balanced crankshafts.

With many manufacturers recommending a piston speed of 2000 ft. per min. for passenger cars, these things become necessary. Furthermore, the gas speeds have increased, and it is necessary that ports be smoother, that the fuel be better vaporized (even though it is heavier), and that the volume of the cylinder is better filled at each stroke.

The small high-efficiency power plant is surely going to increase. To-day there are engines on the drafting boards which should be capable of maintaining 3000 r.p.m. steadily and without vibration of over-stressing of the parts. The high-speed engine provides the answer to the 4-to-50-mile-an-hour flexibility, and it is along these lines that the development of the next 2 years is likely to occur.

Detachable Heads

ENGINES with detachable heads are on the increase and have proved successful with very few exceptions. There are certain precautions to be observed in the design which when followed give a unit that is accessible and easily taken care of.

Where the detachable head has failed it is generally because insufficient water was carried into the head because of improper passages leading from the cylinder casting to the head casting. If these passages are arranged correctly there will be no difficulty in getting the water around the head.

It will be impossible to use anything but a good quality copper-asbestos gasket between the cylinder and the head. If a plain paper gasket is used there will be trouble as soon as a renewal is attempted and a leakage will occur. The copper-asbestos gasket is more expensive, but that expense is justified, and seems necessary.

The benefits to be gained from the removable head are many both from a manufacturing and maintenance standpoint: They are an aid to accurate cylinder grinding and are valuable in that they assist the manufacturer to maintain a very narrow limit of variation on combustion chamber size. To the user they are a great boon when it comes to cleaning out the cylinders, removing carbon or in grinding valves.

The Tractor Engine

ENGINES for tractors must be able to battle successfully with the dust cloud. There are two ways of doing it: First by keeping everything tightly closed so the dust cannot enter and second by making the parts of such materials that they are not damaged by dust. The designer of a tractor motor must do both.

The two important entry points for dust are the breather and the carbureter. A washing arrangement for the carbureter air will prevent the grit from entering. On the breather there is plenty of room for ingenuity to keep the dust out and each manufacturer has a pet method of his own.

In the way of materials, the parts must be hard so that the little diamond-like grains will not cut them, and furthermore, they must be large and stiff to withstand the racking stresses of a tractor.

Engines for 1917 a Culmination of Refinement

Few New Designs But Great Improvements in Detail Result in Higher Thermal and Mechanical Efficiencies—Longer Life and More Economical Manufacture Part of Year's Progress

Part I—The Trends in General

By J. Edward Schipper

THERMALLY, mechanically and economically, the American gasoline engine has received a great forward impulse during 1916. If all the progress made by our individual master builders could be concentrated into a single engine, that power plant would give back more power and useful work from a given quantity of fuel, more energy for a given size, travel farther on a gallon, be less expensive to manufacture, easier to maintain and have a longer life than the product of a year ago.

At this very moment we are in the midst of a period of engine development which makes almost certain the prediction that during the next 12 months a longer stride in the direction of perfection will be taken than the combined steps of the past decade. The latest products of our power plant specialists are capable of a performance as stock jobs that far surpasses the special engines of even 3 years back. And the most significant fact in connection with the development is that nowhere can be found a radical revision of design. What has been accomplished has been done by steady and patient digging into details.

Our engines for 1917 are more efficient thermally, principally because they are more efficient from a volumetric standpoint. The development of the high-speed engine has worked against the development of higher volumetric efficiencies and yet the improvements in detail of design have actually brought forth a net gain in that respect. It will be interesting to note, in going through this story of improvement, how minor changes in the valve action in some instances, the port design in others, and in some cases the rearrangement of very small details have added as much as 20 per cent more power to a power plant.

Mechanical Efficiency Increased

Mechanical efficiency has been increased largely through the carrying out of trends that were clearly expressed a year ago, and chief of these is the reduced weight of reciprocating parts. Next in order comes the balance of rotating masses, and third the better arrangement and individual design of the lubricating system insofar as the placing of the oil bath at points where it is most needed and in the proper quantity is concerned. Mechanical efficiency of an engine is the ratio of the brake to the indicated horsepower, expressed mathematically. It is a measure of the approach towards the ultimate in any given motor size, and when it is stated that the engine of 1917 has a better mechanical efficiency than its predecessor, it means that better performance is being secured from engines of equal displacement. Here again it will be highly interesting to note how the alterations in detail have brought about this important result.

Accessibility and Life

Coming to another broad highway of progress, that of longer life, it is found that the general methods for securing this have been in the reduction of stresses on parts through better design. Put in another way, it means higher factors of safety secured through better arrangement of parts, better materials, safer dimensions in a few instances and indirectly through a very important development in the way of accessibility. The two qualities of accessibility and life are bound very closely together.

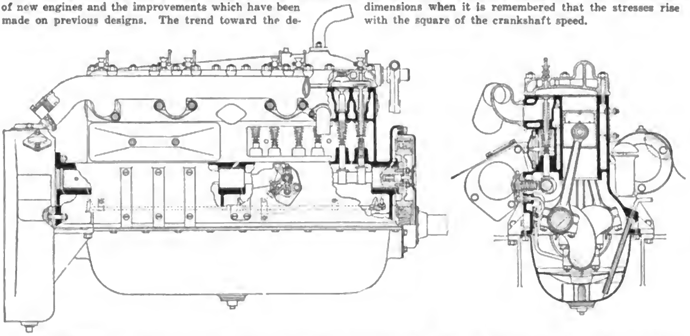
The qualities demanded by the automobile buyer have forced this progress. A buyer of to-day demands a car that will have a speed range averaging from 4 to 50 m.p.h. on high gear. He demands a large power-to-weight ratio to give acceleration and hill-climbing ability and silence. Smoothness, economy and low price are among some of the other requirements that are made and insisted upon. To meet this demand with an engine that has for its working medium a fuel which is ever presenting greater difficulties in the way of vaporization, has taxed the ingenuity of the engineers as never before.

One of the greatest factors this year has been in the matter of material prices. Tungsten valves, aluminum pistons and cylinders, aluminum crankcases, alloy steel crankshafts and gears have been particularly affected by the rises. One result is that no attempt has been made to go beyond experiments particularly in the direction of the aluminum motor, during this year.

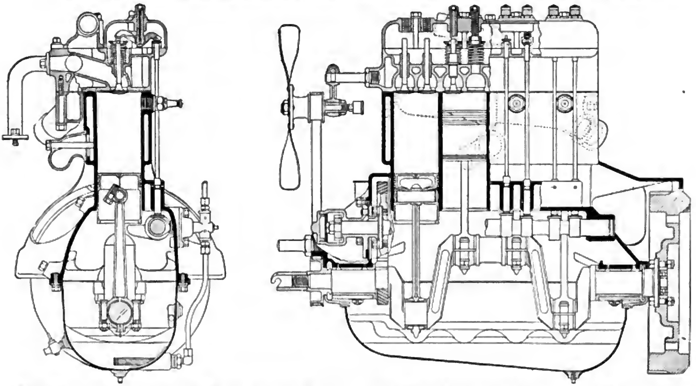
On the other hand, the improvement of machining and casting work has continued at about the same rate as in previous years and much of the credit belongs to these tool room designers who have enabled the motor manufacturer to produce economically and at a profit even in the face of the higher cost of materials.

In the general make-up of the engine, the trend toward the overhead valve seems to have struck its level, and there has been no falling off or increase during the year that is worthy of note. In fact the year is notable for the scarcity of new engines and the improvements which have been made on previous designs. The trend toward the detachable head continues. There has been one concern which has dropped the design, but others have added it so that the scale still shows a balance toward the detachable head.

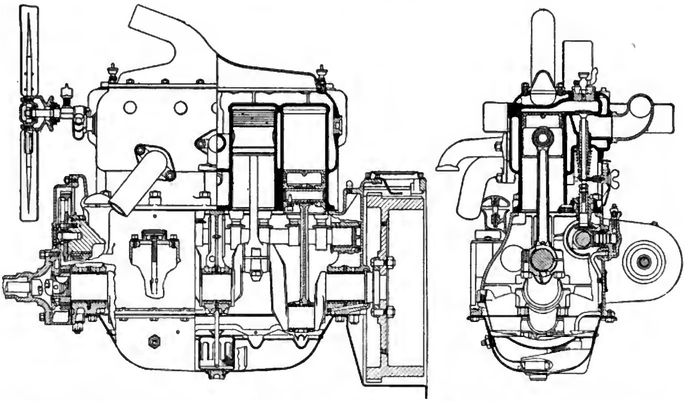
Crankshaft balance has been made more or less of a fad by the exploitation of some new designs through various sales mediums. As a matter of fact no new problems have been encountered by the engineer, beyond those which are natural with the higher speed of rotating and reciprocating parts. Piston speeds have been climbing up to the point where engine designers believe that the best practice for passenger car work is around 2000 ft. per minute piston speed. This is approaching quite close to 3000 r.p.m. and naturally the question of balance assumes proportions of considerable dimensions when it is remembered that the stresses rise with the square of the crankshaft speed.



L-head Continental engine with integrally-cast iron crankcase and detachable head. The end section at the right shows the moon-shaped throws on the crankshaft for balancing purposes. Crankshaft balance has received marked attention this season



Sterling four-cylinder valve-in-head design for light passenger cars. It has a detachable cylinder head with the spark plugs in the side and the fan direct driven from the crankshaft acting as a vibration damper

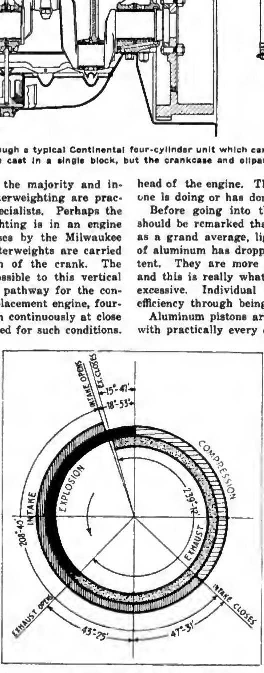


Longitudinal and transverse sections through a typical Continental four-cylinder unit which can be successfully applied to trucks. The cylinders are cast in a single block, but the crankcase and oilpan are separate

The curved-cheek crankshaft is in the majority and instances of elaborate systems of counterweighting are practically unknown among the engine specialists. Perhaps the most interesting case of counterweighting is in an engine developed for gasoline-electric purposes by the Milwaukee Machine Tool Co., in which the counterweights are carried practically into the plane of rotation of the crank. The weights are brought as closely as possible to this vertical transverse plane while maintaining a pathway for the connecting-rod. This is a very small displacement engine, four-cylinder 2½ by 3½ in. designed to run continuously at close to 3000 r.p.m. and all parts are designed for such conditions.

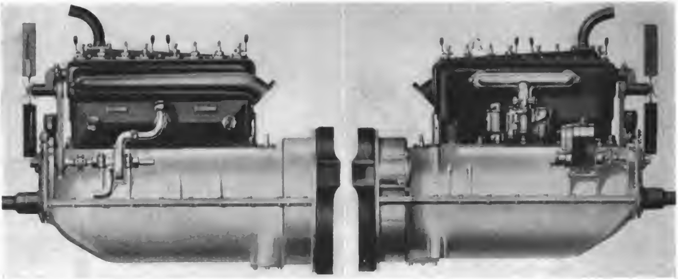
Another high-spot in gasoline engine development is in the provisions made to aid in the vaporization of the fuel. The day is past when the engine builder puts the entire question up to the carbureter maker. Almost every manufacturer of engines has devised some method of preheating the charge, and this in the face of the struggle for higher volumetric efficiencies. Yet it is a matter of necessity now. The day has arrived when the gasoline engine really can burn kerosene, and not a few of them are doing it. The tractor engine is the connecting link where kerosene and gasoline are both being used, and the cored-in intake manifold or the unit intake and exhaust manifold have become very prominent this year. The Waukesha motors have a very nicely worked-out double manifold and the Golden, Belknap and Swartz engine also has a new development in this respect. The Falls intake manifold is now incorporated in the removable head of the engine. These are good examples of what everyone is doing or has done on the newest models.

Before going into the details of motor improvement it should be remarked that power plants are not, taking them as a grand average, lighter than last year because the use of aluminum has dropped off in crankcase work to some extent. They are more powerful for their weight, however, and this is really what counts as long as the weight is not excessive. Individual parts of the engine which promote efficiency through being light have been reduced in weight.



Valve-timing diagram of model 20 Sterling engine, looking at the front of the flywheel

Aluminum pistons are still in the balance. Personal talks with practically every engineer in the motor manufacturing business still give the general impression that they have neither become accepted nor condemned for general practice. It is not so much a matter of price, although in the opinion of one engineer it costs $6 more per motor to use the aluminum with present prices. A year ago though, it seemed as if the aluminum piston would become the standard in all motors within a year. At the present time there is no doubt but that the opinion of the majority of the engineers is that the real lightweight piston has not as yet been developed. On the other hand, it does not lack its firm supporters, so the matter is still on the fence with experimenting actively being carried on all over the country. One interesting fact is worthy of comment and that is, the aluminum piston has found greater favor among the automobile engineers than among the motor manufacturers who build for the trade. Where the aluminum piston has fallen



Both sides of the Wisconsin 4 by 6-in. power plant. This is a four-cylinder unit which is capable of handling large sized trucks. It has considerable flexibility, its stroke-to-bore ratio being 1.5

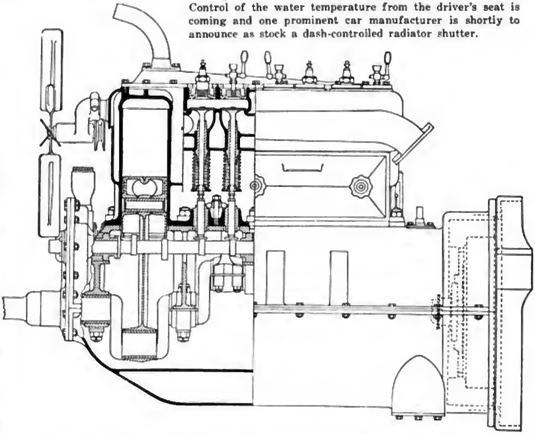
down, particularly in one instance where several cars were called in and changed over to iron pistons, it is because the pistons were made too short and secondly because the workmanship necessary to keep the clearances accurate could not be secured commercially in that particular installation.

The Eight and Twelve

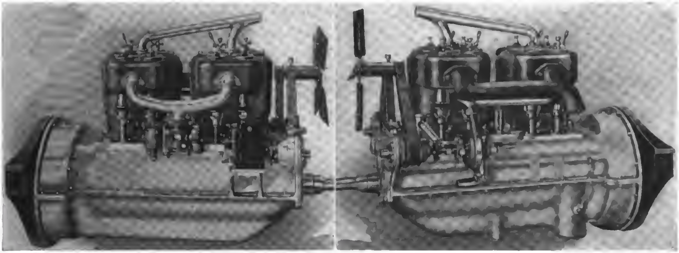
The V-engine cannot be overlooked in touching on the big points in engine practice. All doubt seems to have passed regarding its fitness. It is a question of cost versus performance. The question that each engineer must ask himself in deciding upon the building of a V-motor is whether he can get the same performance from an eight that he can from the six at the same price. The answer is both no and yes, because some have discarded the V, because they have felt that the six gives the better performance-cost answer, while with others it has been the other way around. Examples can be given on both sides so they mutually offset each other and show the point to be one that is open for debate, and since debate is stimulating and is really the key to progress, the V engine, besides having proved its fitness for the work, now stands as a champion of one type of design as opposed to the straight line variety. The shorter, stiffer shafts in the V are offset with the maintenance questions and altogether the question has various ramifications which are carried down to the limits of personal choice. During the year we have had practical demonstrations which have shown both types satisfactory.

Oiling has not changed greatly except that there is a tendency to keep the valve drive submerged so that it cannot become noisy. The details of this will be considered separately but in taking up the main trends it may be stated that oiling by circulating combination pressure and splash is typical. The oil pressure has gone up along with the speeds and now it is not uncommon to send the oil to the rubbing surfaces under a pressure of 40 lb. per square inch.

Cooling favors the pump-circulation among the motor builders. The proportion is about 66 per cent by pump and 34 per cent by thermo-syphon. The latter type of feed has been gaining for the past 3 years among the smaller engines although it has never worked out well for the V engines. Control of the water temperature from the driver's seat is coming and one prominent car manufacturer is shortly to announce as stock a dash-controlled radiator shutter.



Wisconsin four-cylinder 4 by 6-in. engine which is used extensively for commercial vehicles



Wisconsin T-head engine which is known for its hard-pulling qualities. This model is a development extending over several years and has a bore and stroke of 4¾ by 5½

Part II—Mechanical and Thermal Efficiency Increased

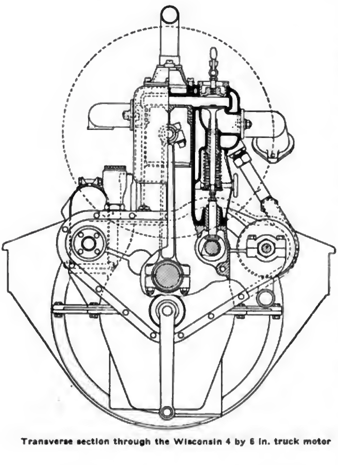
Reduced Friction in Gas Ports, Higher Compressions and Greater Mean Effective Pressure Responsible—Maximum Piston Speeds Vary Through Wide Range

THERMAL efficiency is a measure of the power secured from a given quantity of fuel. Mechanical efficiency is a measure of the power secured from a given size of engine. The two are closely related but still are independent. In increasing each of these factors, the use of a number of detailed improvements has been made which has had a marked effect on engines as a whole.

No other factor has had such attention this year as the increase in volumetric efficiency. This relationship between the volume of gas drawn into the cylinder and the volume of displacement is highly important because it is a direct measure of the relationship between the volume used and the volume wasted in an engine.

A number of factors have worked against the betterment of the volumetric efficiency, the two greatest of these being the higher speeds at which engines are operated and the second is the necessity for heating the heavier grade of fuel which is now being sold. The higher speeds have forced the engine builder to keep increasing the size of the valves year by year until in 1915 the limit was reached. It has been impossible to go any higher and consequently there has been very little alteration in this respect.

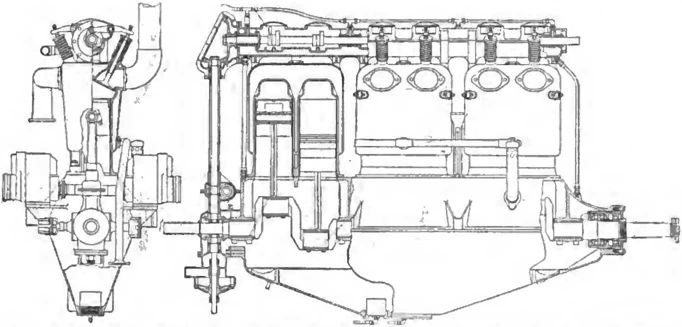
It has been discovered, though, that all the restriction of gas flow has not been in the valve but in the approach to the valve, and consequently there has been a universal housecleaning of intake passages. The Sterling company has even given this volumetric efficiency matter such close attention that its engines have larger intake than exhaust valves.



Transverse section through the Wisconsin 4 by 6 in. truck motor

Integral Manifolds

The use of the cored-in manifold has eliminated some of the bends in the passages, and has permitted of the direct connection between the carbureter and cylinder block. This trend is of about 4 years standing and is still on the increase.



Wisconsin six-cylinder aviation engine which has a valve action quite similar to that used on the Stutz racing cars. The camshaft is carried overhead

No notable change has been made by any of the companies in valve timing. In the overhead valve design there has been one tendency which has worked out very well and that is in the use of the offset rocker arm. In place of having the rocker with the fulcrum at the center it is off center so that the lift of the valve is magnified. The ratio then, instead of being 1 to 1, as it has been in practically every installation up to the last year, is now on a great many 1 to 2 or 3 to 5. The Falls Motor Co., which specializes on a valve-in-head design, has not adopted this practice on the ground that it would complicate replacements which would more than offset any gain.

The advantages claimed for the offset construction is that it eliminates a certain amount of inertia, owing to the smaller travel of the valve parts. This gives the effect of silencing the drive to some extent and further permits the follower to ride the cam better because of the lesser rise on the cam face. Besides this the leverage of the valve spring on the rocker arm, being greater, the spring can be reduced in tension, thereby compensating for the difference in the linkage.

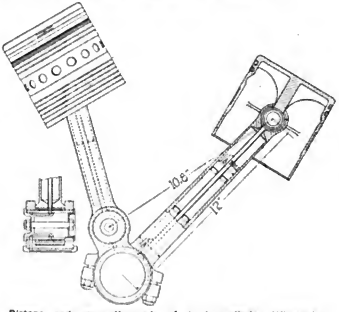
Another feature of the differential rocker is that it allows of a longer dwell of the valve, due to the quicker lift. This certainly reflects in the direction of higher volumetric efficiency as the time of maximum opening of the valve is increased and therefore a longer period is allowed for the gases to make their way into the cylinders.

Compressions are higher than they were a year ago. They vary to such an extent that it is impossible to draw a general trend. In truck motors the combustion space is quite often around 35 per cent of the piston displacement, while in motors like the Continental little six, which is a high-speed passenger car type, this percentage is about 30 or about 85 lb. absolute. The little Falls overhead job with a piston displacement of 180 in. for its six-cylinders has a compression space of 26.5 per cent of the displacement, which would give a compression avarage of over 90 lb. absolute.

Higher Mechanical Efficiency

The reduction in the size of the combustion space and the reduction of friction in the intake passages has more than offset the expansion of the charge due to preheating. The latter has been necessitated by the lower grade fuel, but does not seem to affect the power of the engine. Possibly combustion is more complete with the preheated and gasified charge. On a small engine being developed at the Milwaukee Machine Co. plant a novel scheme is being tried in shaping the passage below the valve in venturi fashion so that there is no break in direction of flow at the valve, but instead it gets the continuous flow effect imparted by the venturi. The throat of the venturi is just below the valve opening.

The increase in mechanical efficiency is largely wrapped up in the same matters as thermal efficiency. The higher compression has resulted in higher mean effective pressures, which in turn means a greater horsepower output from a given displacement. In the reduction of vibration due to the mechanical refinements, particularly in the crankshaft and reciprocating weights, there lies another one of the reasons for the increase in mechanical efficiency. Lower bearing friction will tend to bring this up, but it is to be doubted if this is being secured owing to the higher speeds and larger diameter shafts which have carried the linear bearing speeds close to the limit. When these rise over 1000 ft. per minute they are getting close to the limit for standard cars.



Pistons and connecting-rods of twelve-cylinder Wisconsin aviation engine

Part III—Refinements in Structure and Manufacture

Part-by-Part Study of Motors Shows That Every Detail Has Been Carefully Refined During the Year

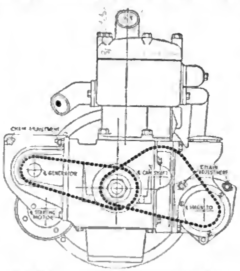
TAKING the engine part by part, it will be discovered that there is some sort of refinement in every detail. This may be in the line of economical manufacture, lighter weight or in some other direction, but there is no part of the engine which has been left untouched. In some parts the line of deviation between passenger and commercial or tractor practice becomes highly marked. In others it has been possible to cut the cost of manufacture while at the same time the efficiency of the resulting engine may actually have been increased.

Gray iron, or what is known as 15 per cent semi-steel, is the king of metals for cylinder use. The aluminum cylinder has not gained this year and will not until aluminum drops from its present price level. In manufacture the ground cylinder is favored over the reamed-in small bores, while above 3 in. there is a leaning toward the reamed finish. One or two manufacturers believe the best results are obtained by rolling. Taking engine manufacture as a whole, it may be said that reaming and grinding are about equally divided. The consensus of opinion on this subject is that the reamed finish is excellent for wearing into a finish fit, while it is easier to grind the surface of the cylinder commercially, within the desired limits.

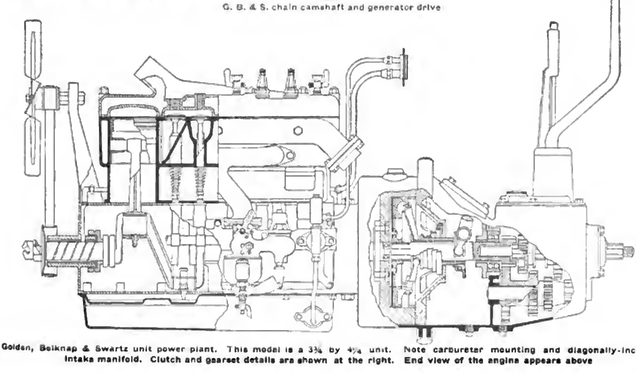
The desire for perfect balance has made the manufacture of equal combustion chamber volumes imperative. One of the Le Roi engines intended for high speed work is checked so that all combustion chambers must be accurate within 3 c.c. for volume. If desired that explosion pressures be equal on all pistons this must be done.

Another important feature in cylinder design is the question of how low the jackets should be carried. There has been a tendency all along the line to increase the water space, and jackets are universally larger. On the latest Falls motor, the waterjackets have been extended clear down to the crankcase line. In detachable head jobs, the passages for water from the main cylinder casting to the head have to be watched particularly. The Golden, Belknap and Swartz company has discontinued the detachable head because of a desire to secure better cooling in the upper part of the combustion space. This is the only instance, however, of where a detachable head has been dropped and the trend may be said to be in the opposite direction. A copper-asbestos gasket is necessary between the head and the cylinder, and any attempt to use a simple paper gasket at this point will be sure to end in failure as soon as a replacement is attempted.

No change in piston material can



G. B. & S. chain camshaft and generator drive



Golden, Belknap & Swartz unit power plant. This model is a 3⅜ by 4¼ unit. Note carburetor mounting and diagonally-inclined intake manifold. Clutch and gearset details are shown at the right. End view of the engine appears above be noted during the year, except possibly a slight backward movement toward iron where aluminum was tried a year ago. As stated, though, the aluminum question has not been settled yet. Gray iron, the same as used for the cylinders, remains far in the ascendancy.

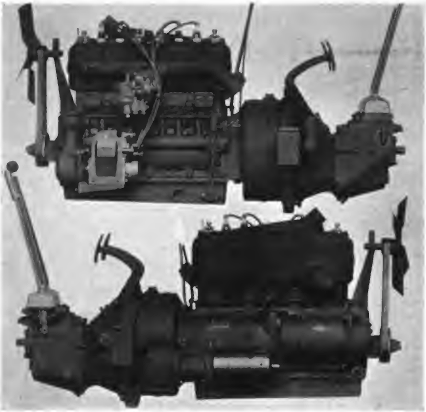
Three rings, all above the piston pin, are practically standard, although one manufacturer, the Falls company, has changed to two rings and will place one of the patent leak-preventers in the top of each unit. For very high speeds two rings are enough, for the lower speeds it requires three eccentric rings to do the work.

Clearances on passenger car pistons have not changed during the year. On tractor work where the engine operates in a cloud of dust that cannot be altogether excluded, the larger clearances have been found necessary. On the Waukesha tractor motor, for example, with the 4¾-in. bore there is a piston clearance at the top of 0.018 in., which is more than double that of the corresponding passenger car engine with iron pistons.

Although cast iron remains as the chief piston metal, pistons have been made very much lighter all along the line. The skirts are thinner and the piston pin boss is not taking so much metal. The pistons are being carefully lapped to the cylinders by many, and in the Continental factory there is an interesting special machine which laps the cylinder by means of a dummy piston. On the little high-speed Le Roi engine the piston skirt is drilled all over with large holes for lightness.

On the Falls motor the piston pin has been lowered slightly and the difference has been taken off the connecting-rod length. A little piston kink that is used by some with good results is to taper off the top of the piston so that the oil instead of gathering on the head of the piston will gather in the space around the outside diameter, thus tending to feed itself between the piston and the wall.

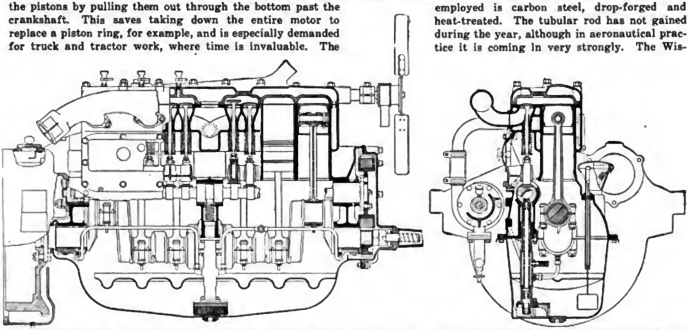
On all motors it is a desirable thing to be able to remove the pistons by pulling them out through the bottom past the crankshaft. This saves taking down the entire motor to replace a piston ring, for example, and is especially demanded for truck and tractor work, where time is invaluable. The majority of motors are being designed in this way, and no doubt others will rapidly fall into line. A slight difference in tractor practice, as compared with passenger cars, is that it is generally thought desirable to put the upper rod bearing in the piston boss with a solid connection to the rod. This is on account of a gain in bearing area. This practice is not universal, however.



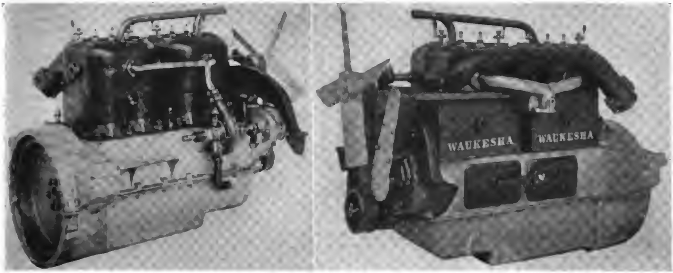
Golden, Belknap & Swartz unit power plant with L-head cylinders for small vehicles

Connecting-Rods

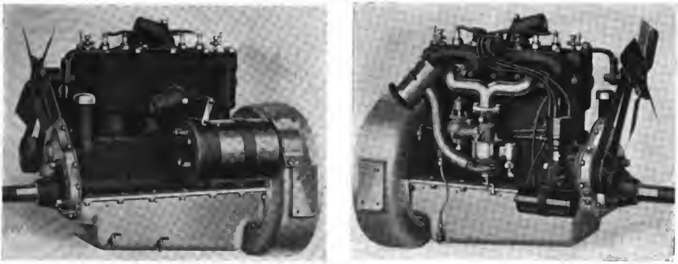
Little change will be found in rod practice. The straight I-beam is used almost universally and the material most employed is carbon steel, drop-forged and heat-treated. The tubular rod has not gained during the year, although in aeronautical practice it is coming in very strongly. The Wis-



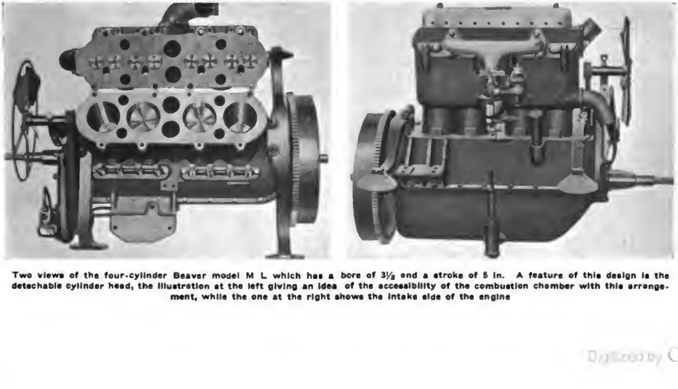
Rutenber model 25, which has a bore of 3⅛ and a stroke of 5 in. This model has been improved by the use of a stiffer crankshaft and is larger in bore than its predecessor, giving altogether a more powerful and efficient design



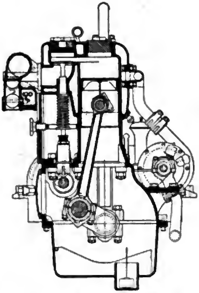
Both sides of a Waukesha engine which is used extensively on tractors. Note how carefully all the moving parts are inclosed to guard against the abrasive action of the gritty dust in which tractors are generally compelled to work



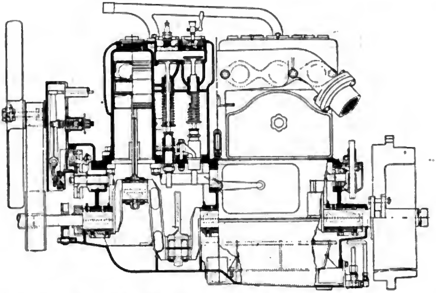
Both sides of the $3\frac{1}{8}$ by $4\frac{1}{2}$-in. four-cylinder Le Roi engine, which is designed for light commercial or passenger car work. Note mounting of electrical units and arrangement of manifolds



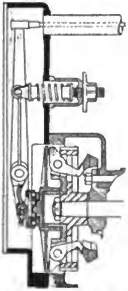
Two views of the four-cylinder Beaver model M L which has a bore of $3\frac{1}{2}$ and a stroke of 5 in. A feature of this design is the detachable cylinder head, the illustration at the left giving an idea of the accessibility of the combustion chamber with this arrangement, while the one at the right shows the intake side of the engine



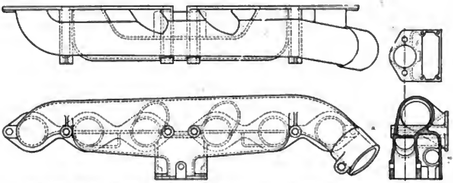
End section through the Waukesha 4½ by 6¾-in. engine, showing the valve and piston assembly details



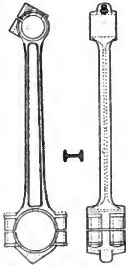
Longitudinal part section of 4½ by 6¾-in. four-cylinder Waukesha, showing mounting of governor behind the fan. Note combined intake and exhaust manifold



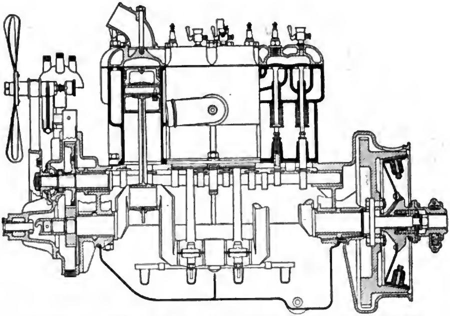
Enlarged view of governor on 4½ by 6-in. Waukesha model



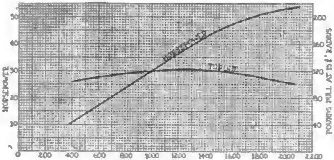
Combined intake and exhaust manifold which is a feature of the 4½ by 6-in. Waukesha, aiding in the vaporization of heavy fuel



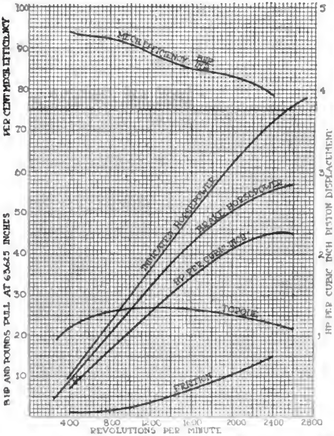
Waukesha connecting - rod showing light H-section



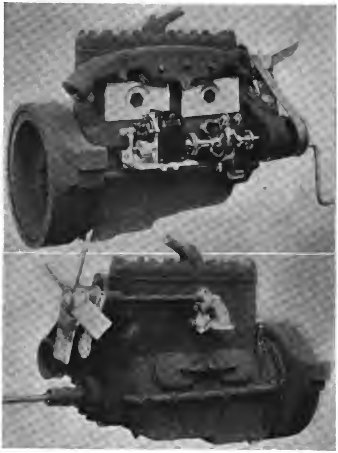
Lycoming four, for medium duty work on commercial vehicles. The generous size of the gas ports and the water passages surrounding the valves is indicative of present trends in this direction



Horsepower and torque curves of 3½ by 5⅛-in., six-cylinder Buda motor fitted with 1¼-in. carburetor



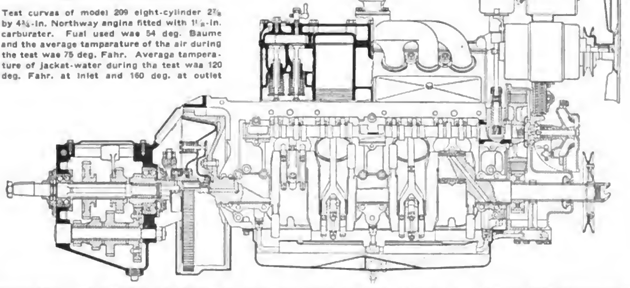
Test curves of model 209 eight-cylinder 2⅞ by 4¾-in. Northway engine fitted with 1¼-in. carburetor. Fuel used was 54 deg. Baume and the average temperature of the air during the test was 75 deg. Fahr. Average temperature of jacket-water during the test was 120 deg. Fahr. at inlet and 160 deg. at outlet



Waukesha motor intended for tractor service. Combined intake and exhaust manifold aids vaporization of kerosene

consin aeronautical motor has the rods made from solid billet steel. Needless to say this practice is far beyond automobile work except for special cases such as racing.

The shorter rod of the Falls motor, due to the dropping of the piston pin, is the only example where rod lengths have been changed.



Northway eight. Note the single three-bearing, sixteen-cam shaft and the use of the forked rods. Both of these points have been much discussed in eight-cylinder practice and this engine is typical of this class of motor

Where manufacturers take the pains to mill off the flash from the drop forged rod they make a gain in the direction of lightness, but it is a time-consuming operation which must be done carefully. In carrying out the balancing operation, all the makers of engines weigh the rods in sets and equalize each set of rods and at the same time keep the centers of mass at corresponding points on each rod, within very narrow limits.

Crankshafts

Crankshafts are still growing stiffer. They are larger in diameter and at the same time shorter. Rutenber has a 2-in. shaft in place of a 1¾ on its standard model 25, and this is typical. This is one of the points in which passenger car and tractor practice approach each other for entirely different reasons. In the passenger car the stiffness is needed to take care of the higher speeds. In tractor work the stiffness is needed to take care of the constant racking of the engine on account of the rough work at constant maximum torque. Tractor engines must stand up. Two days may mean thousands of dollars in crop loss to a large farmer and he must have tractor engines that will work right along indefinitely.

Furthermore, on tractor work the ever-present grit and dust problem enters. It cannot be kept out in spite of washing apparatus on the carbureter and double filters in the breather pipe. It will get into the engine, and the only thing to do is to make the shaft so hard that it cannot be cut by the grit. The Waukesha motor, for example, uses a heavy chrome nickel steel shaft in which the tensile strength is carried up to 140,000 lb. per sq. in. and of a scleroscope test that almost equals tools steel.

Valve Actions and Drives

Silent chain drive has not gone ahead in the last 2 years for camshaft drives. The wide-faced helical gear seems to be about the most popular, and the use of Fabroil, Micarta and other compressed materials is looked upon favorably by a great many. The Waukesha is using a drop-forged gear, which the company believes to be best for the rough work of tractors, especially in that non-resonance is not such a great necessity. In passenger car practice, on the other hand, silence is greatly to be desired, and hence wider faces,

Specifications of 54 Stock Engine Models for 1917 Produced

MAKE AND MODEL	No. of Cylinders	Piston Displacement, Cu. In.	Bore and Stroke in In.	Cylinders Cast	Valves Placed	Valve Diameter in In.	Exhaust Valve Lift	Piston Length in In.	No. of Piston Rings	Weight of Piston in Oz.	Weight Connecting-Rod in Oz.	Length of Connecting-Rod in In.	Width Wristpin Bearing in In.	Diameter Wristpin Bearing in In.
Beaver ... ML	4	192.40	3½x5	block	head	1 5/16	5/16	......	3	......	......	......	1⅜	⅞
Bude ... MU	4	312.00	4¼x5½	block	right	1⅞	⅜	5⅛	3	71½	96½	13½	2¼	1¼
Bude ... IU	4	276.50	4 x5½	block	right	1⅞	⅜	3⅞	3	......	96½	13½	2¼	1¼
Bude ... RU	4	197.23	3½x5⅛	block	right	1⅝	⅜	3	3	46	57½	11½	1¾	1 1/16
Bude ... TU	4	281.70	4⅛x6	block	right	2⅛	⅜	6¼	3	98½	119½	13½	2¼	1¼
Bude ... LSU	6	303.10	3½x5¼	block	right	1⅝	⅜	5	3	46	57½	11½	1¾	1 1/16
Bude ... SSU	6	364.48	3¾x5½	block	right	1 11/16	⅜	5	3	55½	66½	12½	2	1
Continental ... N	4	192.40	3½x5	block	right	1 47/64	10/27	3⅞	3	......	50	10½	1⅜	1 11/32
Continental ... C-4	4	280.60	4⅛x5¼	block	left	2	15/40	5¼	3	......	......	11	1⅜	1 8/37
Continental ... E-4	4	349.90	4½x5½	pairs	left	1 31/32	16/40	5¼	3	......	......	12	......	1¼
Continental ... 7-W	6	224.00	3¼x4½	block	right	1 9/16	9/32	3	3	30	25	8½	1⅛	⅞
Continental ... 7-N	6	303.10	3½x5¼	block	right	1 11/16	20/50	3⅞	3	......	50	10½	3 1/16	1 11/16
Davis ... SD	4	113.10	3 x4	block	right	1⅛	7/32	3	3	28	20½	8	11/16	11/16
Falls ... I-T	6	180.20	3 x4¼	block	head	1⅜	9/32	3¼	3	28	28	8½	⅞	37/50
Falls ... J	6	180.20	3 x4¼	block	head	1⅜	9/32	3¼	3	28	28	8½	⅞	37/50
Ferro ... 9	8	198.00	3 x3½	block	head	1⅜	5/16	3 5/16	3	......	......	7	1⅛	⅞
Ferro ... 6	6	265.00	3¾x4	block	head	1½	5/16	3 5/16	3	......	......	8	1⅛	1
Ferro ... 12	6	162.00	2¾x3¾	block	head	1 5/16	3/11	3	3	......	......	7	1⅛	37/50
Hercules ... C-2	4	226.40	3¾x5⅛	block	left	......	......	......	5	......	......	......	......	......
Hercules ... C	4	197.20	3½x5⅛	block	right	......	......	......	6	......	......	......	......	......
Hercules ... M	4	276.50	4 x5½	block	left	......	......	......	5	......	......	......	......	......
Hercules ... M-2	4	312.00	4¼x5½	block	right	......	......	......	5	......	......	......	......	......
Le Roi ... C	4	138.40	3⅛x4½	block	......	1⅜	......	......	......	......	......	......	......	¾
Light ... H	4	149.20	3¼x4½	block	right	1⅜	5/16	4	3	28	39	9	1⅛	¾
Lycoming ... DU	4	165.90	3¼x5	block	right	1⅜	15/40	4	3	34	46	9½	1 3/16	¾
Lycoming ... U	4	165.90	3¼x5	block	right	1⅜	15/40	4	3	34	46	9½	1 3/16	¾
Lycoming ... DXU	4	192.40	3½x5	block	right	1⅜	15/40	4	3	40	46	9½	1 3/16	¾
Northway ... 108	6	177.00	3 1/16x4	block	head	1½	5/16	3 5/16	3	51	22	9	1¼	¾
Northway ... 208	8	246.70	3⅛x4	block	right*	1½	5/16	3¾	4	†63 3/20	†28 3/20	9½	1¼	¾
Northway ... 309	8	346.30	3½x4½	block	left*	1½	5/16	4¼	4	†77	†41	9½	1⅜	6/7
Northway ... 308	8	346.30	3½x4½	block	left*	1½	5/16	4¼	4	†80	†35	9½	1⅜	6/7
Rutenber ... T	4	192.40	3½x5	block	head	1⅜	5/16	3 13/16	3	40	31½	9½	1¼	⅞
Rutenber ... 38	4	294.00	4⅛x5½	pairs	right	1¾	11/32	5	3	67	67	12	2	1
Rutenber ... 25	6	230.00	3⅛x5	block	right	1 5/16	5/16	3½	3	27½	31½	9½	1⅜	⅞
Sterling ... 20	4	120.20	3 x4¼	block	head	1½	5/16	3⅞	3	24	24	7⅞	1⅛	37/50
Teeter ... H	6	230.10	3⅛x5	block	right	1⅜	5/16	3 5/16	4	27	47	9½	1	1
Teeter ... T17	6	572.50	4½x6	block	opp.	2 5/16	11/32	5	4	58	58	12½	1⅛	1
Waukesha ... TU4	4	202.00	3½x5¼	block	right	1⅝	5/16	3⅞	3	41	66	10⅜	2	1
Waukesha ... B	4	231.90	3¾x5¼	block	right	1⅝	5/16	3⅞	3	46	90	11½	2	1
Waukesha ... R	4	327.00	4¼x5¾	pairs	right	2	5/16	5¼	3	80	76	11½	2⅜	1⅛
Waukesha ... M	4	430.00	4½x6¾	pairs	right	2⅛	11/32	5⅜	3	90	94	12¼	2⅜	1⅛
Weidely 4 ... D	4	211.60	3⅝x5⅛	block	head	1⅝	5/16	4⅜	3	38½	73	11	2	⅞
Weidely 12 ... C	12	390.00	2⅞x5	three	head	1 5/16	⅜	3⅜	3	22	41½	10	1⅜	¾
Wisconsin ... J	4	449.60	5 1/10x5½	pairs	opp	2⅜	⅜	6	3	103	106	12	3	1 5/16
Wisconsin ... JU	4	449.60	5 1/10x5½	pairs	opp	2⅜	⅜	6	3	103	106	12	3	1 5/16
Wisconsin ... A	4	389.90	4¾x5½	pairs	opp	2¼	⅜	6	3	96	106	12	2½	1 5/16
Wisconsin ... AU	4	389.90	4¾x5½	pairs	opp	2¼	⅜	6	3	96	106	12	2½	1 5/16
Wisconsin ... QU	4	166.00	3¼x5	block	left	1⅝	5/16	3⅜	2	34	44	10	2½	⅞
Wisconsin ... TU	4	302.00	4 x6	block	left	2	5/16	5⅛	3	59	85	12	2½	1 5/16
Wisconsin ... UU	4	341.00	4¼x6	block	left	3	5/16	5⅛	3	80	85	12	2½	1 5/16
Wisconsin ... D	4	606.00	5¼x7	pairs	opp	3⅛	⅜	7	4	128	148	14	3⅛	1 7/16
Wisconsin ... M	4	727.00	5¾x7	pairs	opp	2⅞	⅜	7	4	156	148	14	4	1 7/16
Wisconsin ... K	6	909.00	5¼x7	pairs	opp	2⅞	⅜	7	4	128	148	14	3⅛	1 7/16
Wisconsin ... P	6	1090.00	5¾x7	pairs	opp	2⅞	⅜	7	4	156	148	14	4	1 7/16

*Optional. †With forked rod–blade rod lighter. ABBREVIATIONS: Opp, opposite; ext-man, external manifold; int-pas, internal passage compressed fabric gears, the helical pitch and occasionally silent chain drive.

Camshafts have not been altered materially. In fact timing and cam contours have not changed much in the last 3 years. Where the offset rocker has been adopted it has, of course, necessitated a change in the cam, but the average timing will not be found to be much altered. There is a surprisingly small difference between commercial and passenger car work, the latter being slightly more advanced for the higher speed. Exhaust valve opening at 45 deg. before lower center is about the average, while for a few passenger cars it will run nearer 55 deg.

In construction, the valve operating parts have been made lighter. There is quite a trend towards hollow push rods. Waukesha, Northway and Falls have all adopted them this year. The high speeds of the valves have called for a reduction in the inertia of the moving parts through decreased weight. If this inertia is not decreased the followers will not cling to the cams. Steel tubing is used for the push rod, and this is fastened by welding or expanding to the solid steel-hardened follower.

Followers of the mushroom type are growing rapidly and the roller design seems to be falling off among the motor specialists. There is generally an offset on the follower to distribute cam wear. This is secured through the simple means of making no accurate determination of the push rod axial center, so the variations in the casting will give the offset.

Valves

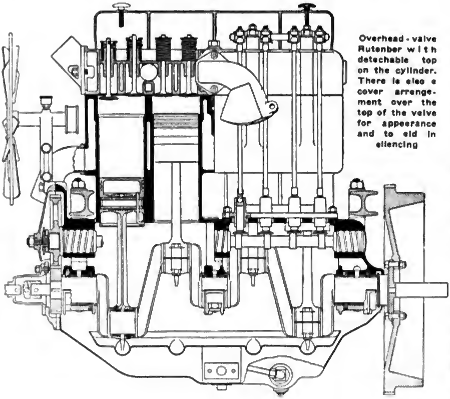
Valve sizes, as stated before, have not changed much. There are quite a number of theories on the subject. For instance, one engineer will say that in truck motors the gas velocities have to be higher in order to take care of the lower grade fuel now on the market. Another truck motor engineer will state that the truck engine valves have to be larger in order to secure the higher volumetric efficiencies at lower speeds. As a matter of fact, practically everyone is going just as large as he believes safe in valve sizes.

Tungsten for valves is rather high in price. The natural result is experiments with other alloys. Wisconsin is using tungsten, and so is Northway, while Waukesha has found 3½

by 17 Manufacturers, Including Principal Dimensions

Width Connecting-Rod Lower End Bearing in In.	Diameter Connecting-Rod Lower End Bearing in In.	Diameter Crankshaft	No. Crankshaft Bearings	LENGTH OF CRANKSHAFT BEARINGS				Intake	Water Circulation	Motor Lubrication	Material of Crankcase	Material Cylinders	Material Piston	MAKE AND MODEL
				Front	1st Inter.	2nd Inter.	Rear							
2	1¾	2	3	2½	2	.	3½	ext-man	thermo*	circ-spl	.....	iron	iron	Beaver ML
2¾	2¼	....	3	3½	2½		4	int-pas	cent	pres	iron	iron	iron	Buda HU
2½	2¼	....	3	3½	2¾		4	int-pas	cent	pres	iron	iron	iron	Buda IU
2	1¾	......	3	2½	2¾		3½	int-pas	thermo	circ-spl	alum*	iron	iron	Buda RU
2	2½	...	3	3¾	3¼	.....	4¼	int-pas	cent	pres	iron	iron	iron	Buda YU
2	1¾		4	2½	2¼	2¼	3½	int-pas	cent	circ-spl	alum*	iron		Buda LSU
2	2		4	3½	2½	2¼	4	ext-man	cent	circ-spl	alum	iron	iron	Buda SSU
2 3/16	1¾	1¾	3	3½	2½	....	3 5/16	int-pas	cent*	sp-pres	alum	iron	iron	Continental N
2 10/37	2	2	3	2¾	3	....	4 5/32	int-pas	cent*	circ-spl	alum	iron	iron	Continental C-4
2	2¼	2¼	3	3 7/16	3½	....	4 11/16	int-pas		circ-spl	alum	iron	iron	Continental E-4
2	1¾	1¾	3	2 14/25	3	...	3 5/16	int-pas	cent	sp-pres	iron	iron	iron	Continental 7-W
2 3/16	2¼	2¼	3	3½	2½	....	3 3/32	int-pas	cent	sp-pres	alum	iron	iron	Continental 7-N
1½	1½	1¾	2	2			2 11/16	int-pas	thermo	circ-spl	iron	iron	iron	Davis SD
1¾	1 5/16	1 5/16	3	2 11/16	2		3	int-pas	thermo	sp-pres	iron	iron	iron	Falls 1-T
1¾	1 5/16	1 5/16	3	2 11/16	2		3	int-pas	thermo	sp-pres	iron	iron	iron	Falls J
2	1½	1½	3	2¾	2¼		3	ext-man	thermo	pres	iron	iron	iron	Ferro 9
2⅜	1¾	1¾	3	2¾	2½		3½	ext-man	thermo	pres	iron	iron	iron	Ferro 8
1	1½	1¾	2	2 10/19			2½	ext-man	thermo	pres	iron	iron	iron	Ferro 13
.....	.....	.....	3					ext-man*	gear	pres	iron*	iron	iron	Hercules C-2
.....	.....	.....	3					ext-man*	gear	pres	alum*	iron	iron	Hercules C
.....		.....	3					ext-man*	cent	pres	iron*	iron	iron	Hercules M
.....	.....	.....	3					ext-man*	cent	pres	iron*	iron	iron	Hercules M-2
.....	.....	.....	.....					ext-man	thermo	circ-spl	alum			Le Roi C
2	1¾	1¾	2	2¾			2¾	int-pas	thermo					Light H
2¼	1½	1¾	2	3¼			3 11/16	int-pas	thermo	circ-spl	iron	iron	iron	Lycoming DU
2¼	1¾	1¾	2	3¼			3 11/16	int-pas	thermo	circ-spl	iron	iron	iron	Lycoming U
2¼	1¾	1¾	2	3¼			3 11/16	int-pas	thermo	circ spl	iron	iron	iron	Lycoming DXU
1½	1¾	1¾	3	2¼	1¾		2 11/16	ext-man	cent	circ-spl	iron	iron	iron	Northway 108
2 5/39	2½	2½	2	3½			3½	ext-man	cent	pres	iron	iron	iron	Northway 209
2½	2½	2½	3	3½	3		3 11/16	ext-man	cent	pres	iron	iron	alum	Northway 309
2½	2½	2½	3	3½	3		3 11/16	ext-man	cent	pres	iron	iron	alum	Northway 308
2	1¾	2	3	2¾	2		3 5/8	ext-man	thermo	circ-spl	iron	iron	iron	Rutenber T
2½	2½	2½	3	3¼	3		4¼	ext-man	cent	pres	iron	iron	iron	Rutenber 38
1½	2	2	3	2¾	2½		3½	int-pas	cent	sp-pres	iron	iron	iron	Rutenber 25
1½	1 9/16	1 9/16	2	3			3	ext-man	thermo	circ-sp	iron	iron	alum*	Sterling 20
1 11/16	1¾	2	3	2¾	2½		3	int-pas	cent	sp-pres	iron	iron	iron	Teetor H
1½	1¾	2	4	4	1¾	1¾	4	int-pas	cent	sp-pres	alum	iron	iron	Teetor T17
2¼	2	2	3	2½	2½		3	int-pas	thermo*	circ-spl	iron	iron	iron	Waukesha TU4
2¼	2	2	3	2½	2½		3	int-pas	cent*	circ-spl	alum	iron	iron	Waukesha R
2½	2	2	3	2 5/16	3½		3½	ext-man	cent	circ-spl	alum	iron	iron	Waukesha R
3	2	2	3	3½	4¼		4½	ext-man	cent	circ-spl	alum	iron	iron	Waukesha M
2¾	2	2¼	3	2½	2½		4	ext-man*	cent	sp-pres	iron	iron	iron	Weidely 4 D
1 7/8	2	2¼	3	2½	2½		4	int-pas	cent	sp-pres	alum	iron	iron	Weidely-12 C
2½	2	2	3	3¼	3½		4	ext-man	cent	pres	alum	iron	iron	Wisconsin J
2½	2	2	3	3½	3½		4	ext-man	cent	pres	alum	iron	iron	Wisconsin JU
2½	2	2	3	3½	3½		4	ext-man	cent	pres	alum	iron	iron	Wisconsin A
2½	2	2	3	3½	3½		4	ext-man	cent	pres	alum	iron	iron	Wisconsin AU
2	2	2	2	3			3½	int-pas	thermo	circ-spl	iron	iron	iron	Wisconsin OU
3	2	2	4	2½	2½	2½	3½	ext-man*	cent	pres	alum	iron	iron	Wisconsin TU
3	2	2	4	2½	2½	2½	3½	ext-man*	cent	pres	alum	iron	iron	Wisconsin UU
3½	2¾	2¾	3	4	4		6	ext-man	cent	pres	alum	iron	iron	Wisconsin D
3½	2¾	2¾	3	4	4		6	ext-man	cent	pres	alum	iron	iron	Wisconsin M
3½	2¾	2¾	4	4	4	4	6	ext-man	cent	pres	alum	iron	iron	Wisconsin K
3½	2¾	2¾	4	4	4	4	6	ext-man	cent	pres	alum	iron	iron	Wisconsin P

entrifugal pump; thermo, *thermo-syphon;* circ. spl, *circulating splash;* pres, *pressure;* spl pres, *splash pressure;* alum, *aluminum;* gear, *gear pump.*



Overhead-valve Rutenber with detachable top on the cylinder. There is also a cover arrangement over the top of the valve for appearance and to aid in silencing

per cent nickel steel very satisfactory. Another concern is experimenting with chrome nickel, and a few who cannot secure the material at commercial prices are trying other alloys. There is also a strong contingent in favor of the cast iron valve.

Oiling Systems

Higher pressures are used in oiling to compensate for the higher speeds. In the engines made by passenger car manufacturers there has been a tendency towards full pressure feed. This has been followed to some extent by the motor manufacturers. The Buda oil pump delivers a pressure of 40 lb. at 1000 r.p.m. of the crankshaft, and this is typical of other practice.

In oil pump practice there has been a little uneasy shifting around, both in the pump and in the drive. The Waukesha changed to a plunger pump a year ago, but came back to the gear device. Rutenber, on the other hand, has changed over from a vein pump to a plunger. The gear pump is in the majority, with the drive taken off the end of the camshaft. Oil leads are larger and as a rule are confined within the limits of the motor.

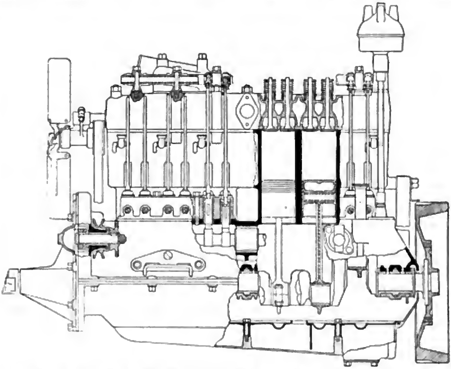
Some of the companies have simplified the oiling system to the extent of making it entirely self-contained. This has been a tendency for three years or more. The Wisconsin pump can be removed by taking four studs out of the bottom of the case. The Falls company has removed the external pipes this year and made the system self-contained. In the Le Roi engine there is a compartment surrounding the camshaft, which acts as a secondary oil chamber. It is 8 in. above the crankshaft and consequently gives that much hydraulic head for continually maintaining a supply in the splash troughs.

The matter of maintaining the oil in the splash troughs becomes very important in tractor work where a machine may be forced to operate on the side of a hill or constantly up-grade while it is running some stationary installation or, on the other hand, down hill. Waukesha has solved the problem of rectangular troughs, in which the scoop dips at the center or diagonal intersection of the rectangle. The scoop has been designed to give sufficient dip at any possible inclination.

Dust filters must be used in the oiling system of the tractor engine. Particularly is this true in the breather. One engine uses two screens in the breather pipe, the top removable and the other stationary. The continual cloud of gritty dust that surrounds the tractor is its worst enemy, and although the grit cannot be altogether kept out, every precaution must be taken. Tractor motors must be entirely inclosed for this reason.

Aeronautical

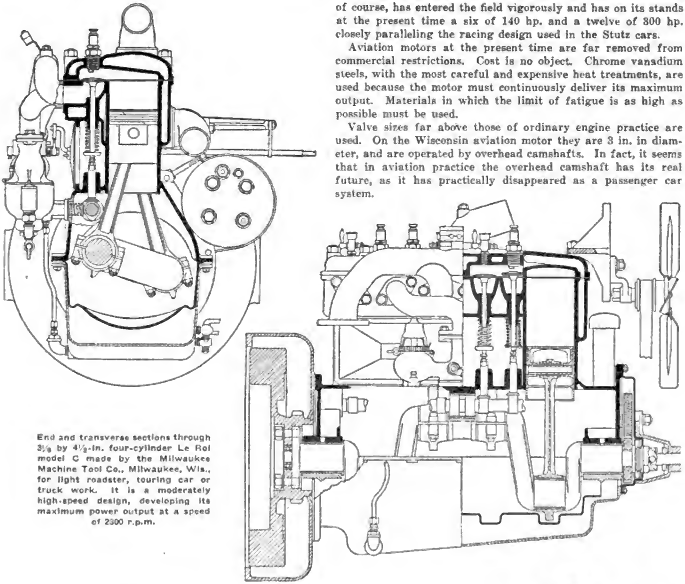
All through the motor industry there is a feeling of preparedness in the direction of aeronautical work, Although motors are in such demand that prospective automobile manufacturers have gone from factory to factory begging for production, enough time has been snatched to give the aeronautical side of the question a little attention. Wisconsin,



Falls small six-cylinder engine which is intended for passenger car use. Like all the Falls motors, this has an overhead valve action and a very efficient form of combustion chamber which is clearly shown in the end cylinder of course, has entered the field vigorously and has on its stands at the present time a six of 140 hp. and a twelve of 300 hp. closely paralleling the racing design used in the Stutz cars.

Aviation motors at the present time are far removed from commercial restrictions. Cost is no object. Chrome vanadium steels, with the most careful and expensive heat treatments, are used because the motor must continuously deliver its maximum output. Materials in which the limit of fatigue is as high as possible must be used.

Valve sizes far above those of ordinary engine practice are used. On the Wisconsin aviation motor they are 3 in. in diameter, and are operated by overhead camshafts. In fact, it seems that in aviation practice the overhead camshaft has its real future, as it has practically disappeared as a passenger car system.



End and transverse sections through 3⅛ by 4½-in. four-cylinder Le Roi model C made by the Milwaukee Machine Tool Co., Milwaukee, Wis., for light roadster, touring car or truck work. It is a moderately high-speed design, developing its maximum power output at a speed of 2300 r.p.m.

Schoenrock Uses Two-Diameter Piston and Two Sets of Valves

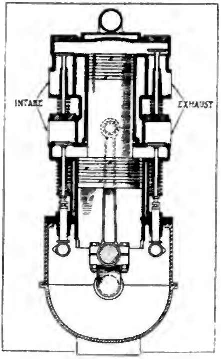
THE section at the right of the page illustrates the Schoenrock engine, which incorporates a novel adaptation of the four-cycle principle. The object of the engine is to secure the benefits of four-cycle practice with twice the number of expansion strokes. As will be seen, there is no great difference between this engine and any other except that it has a two-diameter piston, the smaller diameter being at the top and acting as the seal for the expansion chamber while the larger piston is at the bottom and is merely a factor in the scavenging of the engine.

Piston a Unit

There are two sets of valves, the upper left and lower left being intake and both right valves exhaust. The double piston is a unit so that as the gases are expanded they act upon the same rod, transmitting the power to the crankshaft. On exhaust the flow is very much the same as on the ordinary four-cycle engine.

May Be Rotary

In operation, as already stated, the engine has twice the number of expansion strokes, this being gained by the fact that while the small piston is compressing the gas the larger piston is exhausting the burnt gases. Although this drawing shows the engine with poppet valves it may be constructed with rotary or any other type. The intake valves are at the left of the cylinder block and the exhaust valves at the right, as indicated in the illustration. The connecting-rod mounting is also shown in the drawing.



War Develops German Industry

Necessity for Economy in Metals Makes Chassis Design Simpler, Stronger and Lighter—Lack of Rubber and Other Materials Brings Out Synthetic Product for Tires

By E. A. Langdon

GERMANY'S automobile industry has played a part of the utmost importance in enabling that country to withstand the assaults of its enemies since the beginning of the war. Needless to point out, this industry has not escaped the influences and effects of the great conflict and these results of the abnormal conditions created have been of both a detrimental and a beneficial character. For example, most of the cars which were drafted for service at the beginning of the war have long since been consigned to the army's great clearing houses for material, where they have been dissected and their various units used for other purposes or in repair work, or the rusty skeletons of their chassis, plucked bare of every detachable part and accessory, are gradually disintegrating in the mire of a thousand battlefields.

Chassis Are Simpler

Chassis construction has undergone a marked change, both in design and materials employed. Chassis are stronger and lighter, due to the elimination of many special parts formerly used, but now discarded for reasons of economy, and also because of the marked increase in the use of aluminum, not only for crankcases, gearboxes, etc., but also for such parts as valves, shafts, cylinder castings and other units for which an immense amount of copper, steel and iron was formerly required. A number of aluminum alloys of great strength has made this wide use of the metal possible, one of these alloys closely resembling the qualities of steel.

Gas from Coal for Fuel

An ingenious method of supplying automobile fuel has enabled the Germans to solve the gasoline shortage problem, which has at times remotely threatened to become serious since the beginning of the war, in spite of the enormous quantities of the fuel which Roumania practically made a compulsory condition to the purchase of wheat by Germany. Gas distilled from coal, and somewhat resembling illuminating gas in a liquefied or highly compressed state, is carried in steel tanks and fed to the engine through reduction valves.

One of the most important developments directly due to the war is claimed by the Germans to be the perfection of the manufacture of tires and other articles in which rubber was formerly used by synthetic processes. They also state that this product will compete successfully in quantity and quality with natural rubber in the world's markets following the termination of hostilities.

Industry Is Concentrating

German automobile, parts and accessory manufacturers, as well as the truck builders, are being fused into a powerful, compact unit of industry and are counting on their co-operative abilities to overcome trade barriers existing against their products at the end of the European struggle. It is even possible that agricultural and commercial motor trucks and tractors will represent a majority of the products of the industry for two reasons. One of these reasons is the large demand for these machines due to the scarcity of horses caused by the war, and the other is the economical advantage of standardized production.

Army Cars Different Now

The automobiles used by the army, at the present time, differ considerably from those used at first. Needless to state, there is hardly a car left which was drafted for service at the beginning of the war, except a few luxurious private cars used by the officers of the general staff and German princes. The supply of machines, however, must be replenished, and it is remarkable how, under the stress of necessity, German engineers have given up more and more special parts which went to make the machines as nearly perfect as their builders could conceive them; hence the cars are approaching an ideal of strength and simplicity, both in regard to design and materials used.

Aluminum Widely Used

The most striking feature, perhaps, is the immensely extensive use of aluminum, not only for crank and gear cases, but for valves, shafts, cylinder heads and jackets, supplanting a great deal of copper, iron and steel used before. The reason for the usefulness of aluminum is that the Germans have developed a number of very strong alloys, one of which is said to closely resemble the qualities of steel. The economic side of the matter is that the Germans mine coal belonging to France and to a considerable extent by French labor, and this coal enables them to manufacture tremendous quantities of aluminum cheaply by the electrical process.

This cheap production on a very large scale of coal has also aided the Germans to cope with their shortage of gasoline, as the gas obtained by distillation of the coal is used very largely to replace gasoline in stationary engines, marine engines, etc. This gas, which resembles liquefied or highly compressed illuminating gas in many respects, is transported in steel tanks from which it is drawn through suitable reduction valves. The reason for using this gas instead of industrial alcohol, which was used so widely in the early months of the war, is the necessity of economizing in potatoes, the chief staple food of the German people.

Synthetic Rubber for Tires

Rubber, the Germans say, will rapidly become a matter of the past after the war. All the tires used on German cars, as well as all the other rubber articles required by the Central Powers, are now made artificially, or rather synthetically. The Germans promise quite seriously that in the future their product will equal in quality and compete very successfully with Para and Ceylon rubber, and they never grow tired of repeating, with grim sarcasm, the fact that they are obliged to their enemies for forcing them to develop rapidly an invention which otherwise might have come along slowly in the course of years.

It has been stated above, and in some earlier article as well, that the Germans are organizing their industries more and more on the "American," that is, the centralized, concentrated plan, and that by this means they intend to overcome whatever barriers they might have to break down in the market of the world when the war is over. This applies to the automobile industry as well, and in all likelihood, it will, after the war, face the world market as a solid combination, or "Kartell," as they call it in Germany—which is very little different from a trust. On the other hand, it is not at all impossible that the whole German automobile industry will devote itself to just one class of work, or chiefly so, namely, the building of trucks for agricultural and commercial uses.

The Need for Trucks

That the need for commercial motor vehicles will be even greater than for pleasure cars, after the war, follows simply from the fact that the stock of horses, with the exception of the breeding specimens, will be practically killed off by the time the war is over. Besides, the farming population, and especially the smaller ground holder, will be very much dependent on government support in every form, and as the subsidy policy for automobile trucks will doubtless be continued with even greater vigor than it was begun before the war, the incentive for buying efficient modern equipment will be correspondingly increased.

While the beginning of the war, or, let us say, the first 12 months, saw the introduction of many new devices and processes of warfare, such as movable siege guns, asphyxiating gases, liquid fire, electric barbed-wire entanglements and so forth, the number of innovations in war technique since the end of the first year have been rather small. The reason for this is not quite easy to understand, but, as several officers of the engineering branch of the German army have put it, is just about this:

Trying Out the New Things

"Germans, Austrians, French, and, in spite of their denials, British, have for years preceding the war invested an immense quantity of study and labor in the possibilities of the present war, and according to their ideas of the problems it would present, have worked out different schemes to overcome the difficulties they assumed they would have to face. Consequently, as the different ideas of warfare were given reality by the war's first year, the different inventions and discoveries and methods, either perfect or made so during that period, were brought into action. This introductory period being past, and the gravity of the struggle centering upon the Western field, methods had to conform to the situation given there. What is this situation? You may liken it to a game of chess on an immense scale, a game in which each player according to known ways of playing is capable of checkmating his opponent at the latter's first grave mistake. Hence the endless feeling-out and experimenting on both sides. Now and then, one or the other player believes to have found a new solution, but upon attempting to put it into practice finds, sooner or later, that he has not gaged the situation correctly. It is simply the impossibility of solving a problem of strategy by tactics. Therefore, whatever technical improvements one side or the other may bring out now, can be of but little bearing on the result. Both sides realize this, but the difference is that we are ready to express our understanding of the situation."

These words are almost verbatim what the writer learned from a high "genie" officer, now retired because of injuries. The interview took place in September, and the writer having obtained some English papers in Holland a few days before, asked the colonel above quoted: "How about the new British 'tanks'?"

The British Tanks

The officer stroked his long mustachio, and answered slowly: "It is quite a novel development, and its full efficacy cannot as yet be approximated. But if you want my opinion of the 'tanks,' let me tell you that on the Western front, two things count, men and explosives. Other devices are entirely minor. The men being required to serve the machinery of war, the rest consists in blasting to bits as much as possible of the enemy's position. Whatever is not an explosive is subject to destruction by explosives; and all we can tell after a few days' experience, so to speak, with the 'tanks', is that this maxim holds good in their case. They move slowly, at hardly more than 5 miles an hour, and that makes them splendid artillery targets."

I requested the colonel for a description of the "tanks."

"Mind you, this is far from being exact. Well: they are about 65 ft. long, almost 10 ft. high and not much narrower. The most striking feature is propulsion by endless steel lattices, engaged in the manner of chains by a set of driving wheels arranged on each of the axles. Steering is by a central pair of wheels placed like that of the old-time tricycles and arranged back of the machine. The power plant is situated close to this third wheel, entirely out of view from in front, and I conclude that the driver is guided by a sort of periscope eye placed in a well shielded position at the front of the machine. I doubt whether this engine weighs less than a 4:4:2 type of locomotive, and therefore would easily require 400 to 600 hp. for driving it. I know that Allied journals state the machine is like a railroad engine and carries its own rails along. But this is not so. These 'rails' are continually being laid over the most torn up ground imaginable, and the simile would be more correct if they would say that traction is by means of a pair of wheels, one on each side, with a theoretical spoke length of several hundred feet, but so actuated as to overcome the difficulty which this radius would cause if power were applied at the geometric center of the wheel. We have not as yet captured a 'tank', chiefly because when—as it happened in several cases—a 'tank' gets beyond control, it is blown to smithereens by the army of which it is part, so as to keep us from capturing it. Hence, you understand, all these statements are, so far as the construction is concerned, a matter of deduction. I should not be surprised, however, if these huge machines were driven, instead of by gasoline motors, by Diesel engines. By the way, isn't there a similar tractor made in the States?"

An American Prototype?

I failed to recall at the moment. The colonel gave me a merry look, like a schoolboy finding that there is one thing he knows and the teacher does not, and opened a drawer of his office desk. After a few seconds he handed to me a catalog of the Holt tractor factory! There was an illustration of what no doubt served as the original type for the "tanks," the caterpillar drive used on an American agricultural tractor.

The privates, "Kanenenfutter," who return from the trenches for a brief furlough to the "hinterland," are less easy about the new fighting machines. They maintain that when the "tanks" were first introduced, they made quite a terrible impression on the soldiers in the trenches, and it took quite a while until the suitable artillery could be got into readiness. But now the "tanks" are said to be a normal feature of the fighting like poisonous gases, and the soldiers with their marvelous faith in the ability of the army's rank feel certain that very shortly their effects will be quite checked and possibly beaten by a counter-invention. But there, the words of the engineering officer will probably prove true.

Friendly Toward America

A remarkable feature of the situation at present is the feeling toward America. The antagonistic sentiment which existed about a year ago has very much subsided, and the ideas then prevalent, about "*révanche*" toward America, for supplying the enemy with ammunition and for restricting the submarine warfare, have almost disappeared, and by the intelligent Germans are passed over with a slight embarrassment. When you ask them about it, they say that they are so certain of their success in the end, that they will need their energies for something else than hitting back, after the war, at who might have harmed them during the war. The fact is, they realize that they will need very much raw material when the seas are open once more, and that it is no use antagonizing the people from whom you will have to buy most of it and who will find customers aplenty.

Big Tariffs in Europe After War

Of course, trade, like everything else, will be very different after the war. New methods will have to be used, both in buying and selling, and especially will the matter of credit and payment be altered. After the war, especially where such articles as automobiles, and particularly trucks, are concerned, a considerable part if not most of the business will be done on a basis of instalment payments from the consumer. In other words, American exporters here will meet a similar condition to that prevailing in South America, where payments are on long terms. It is not improbable that the same condition will apply to all of Europe, at least the Continent; and hence, exporting will call for more capital than it did before the war. Add to this the likelihood that every one of the European States or groups of States will surround itself by a tariff wall, and it follows that business with Europe after the war will be, although big, yet not an easy matter to transact, nor will it present any opportunities for the get-rich-quick type of business man.

Preparation Is Imperative

It would be well for the American automobile manufacturer who is at present reaping handsome profits to look into the future, organize his plant in the most efficient and economical manner imaginable, study the past methods required in trading with different European countries and educate their working, selling and advertising forces with a view to taking up the hard work of exporting when opportunity will present itself. In this regard, the parable of the wise and foolish virgins will once more prove significant, as it has proved so many times in the past.

Merchant Marine a Necessity

In closing, the writer would like to add one more thing which, though not of immediate automobile nature, should make American manufacturers think. American business men, not only in Germany and Austria, but also in Holland, Switzerland and Scandinavia are continually bemoaning the fact that there is so little of an American merchant marine with ships plying between the old and new world. They fail to see why their business, often enough in merchandise which cannot in any way be construed to be contraband, should be paralyzed and, as it was in many cases, destroyed, because nations other than their own are at war, and things seem to have come to the point where the belligerents force neutrals to look out for every one's interests except their own.

Fiat Armored Trucks in Battle Service

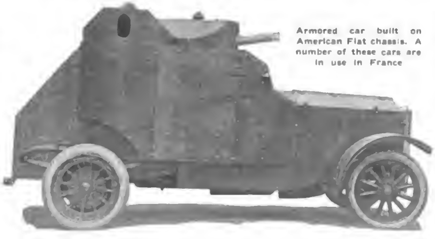
AMERICAN automobile chassis are numerous on the battlefields of France, both as the conventional passenger car and covered with armor plate. These armored cars are built both on motor truck and passenger car chassis, depending upon the character of the service for which they are intended. Thus massive, heavy chassis are used for field work where thick, weighty armor plate is a necessity, due to possible exposure to heavy fire and where speed is a secondary consideration. For swift, light armored types powerful passenger car chassis are frequently utilized, the plating not being as heavy since these cars are usually employed for scout work and quick dashes, so that they are not called upon to sustain heavy rifle or artillery fire for any length of time.

A number of the armored cars now in service in the Somme district and around Verdun are built on Fiat chassis produced in the American factory of the Fiat Co. at Poughkeepsie, N. Y. The illustration shows one of these Fiat armored cars. The motor is a 55-hp. type; wheelbase is 128 in.; transmission four-speed; and clutch multiple disk. In fact, the chassis with the exception of heavier springs, dual rear wheels, and the double steering controls, is identical with the model 55 passenger car chassis which the Fiat company is producing as its regular standard car. The chassis is equipped with the regular forward steering, so that the front driver operates the car as under ordinary conditions. There is a rear steering arrangement, so that the second operator facing backward at the rear end of the car can steer the car backward and have the car under the same control as the front operator—the advantages being that the armored car can run up as close to the firing line as desired, use the turret guns, and immediately back straightaway without having to turn around and subject the car to broadside firing from the opposing lines.

The radiator at the front of the car is armored with a V-shaped plate, so that any bullets striking will be deflected, without doing any damage.

On the chassis are mounted two rapid-fire guns in revolving turrets. Both the front and rear operator are protected by shields over the slits in the armor plate, through which they may look while under fire. The front operator has an opening, which is kept open when not in danger, but which can be closed down to the minutest point when approaching the firing line, giving almost perfect protection.

The chassis is equipped with dual wheels rear, single wheels front. No air is used in the tires, so that puncture is not as serious as with air-filled types, the regular casing being filled with a special filler material adopted by the English government, although these tires are mounted on demountable rims for quick changing if necessary.



Armored car built on American Fiat chassis. A number of these cars are in use in France

More News Is Wanted in Advertising

Value of a Good Name Considerable—Important That Price Be Stated—Foolish Catch Words Usually Disliked by Buyers

THE difference between American and British advertising is generally accounted for by the statement that the latter is "English," which explanation is given for anything and everything that the Briton does in his own way. But that the English ad reader is just as keen as his American cousin for attractive advertising and for ads that "tell him what the thing can do" and what it costs is indicated in a letter to *The Motor*, England, from one of its readers.

He advances the very modern thought that there is not enough sympathy between the advertiser and the prospective buyer, a criticism that is not necessarily confined to the British Isles. "One often wonders," he says, "whether the advertisers can regard their efforts from the standpoint of the buyer.

"The commercial value of advertising cannot be too highly esteemed. To be known is essential, and since first impressions have a peculiar adhesiveness, much—very much—depends upon one's introduction to some new commodity placed upon the market. Makers vie one with another to outdo in attractiveness, to excel in superior claims, to show their goods in the fairest light, and thereby eclipse the less-dazzling efforts of their rivals.

"Apart altogether from any commercial or speculative purpose, the scanning of the advertisement pages of such a paper as *The Motor* is full of interest, and one often wonders whether the advertisers can regard their efforts from the standpoint of the buyer, and whether they fully appreciate the effect upon the general mind. Sometimes one feels convinced that there is an absolute want of sympathy between advertiser and purchaser.

Must Attract Attention

"To attract attention to an article is the primary intention, and this may be accomplished in various ways. At the one extreme is the depicting of the absurdly ludicrous, freak forms and figures and faces, distorted and grotesquely abnormal features; but the effect of these, though at first they may succeed in drawing attention, is to repel; and probably every motorist could name a list of good and useful articles which are studiously avoided simply because of the advertiser's design which offended the sense of propriety.

"Just now, too, the figure of a man of good stature and military age at once arouses the thought that he ought to be at the Front and not soliciting a purchase of his goods. To rescue old gods from the backwaters of mythology and equip them in extremely modern guise adds no fascination to the goods they are supposed to adorn. It is always a risk to insert a face as a winning feature of an advertisement, unless that face have some peculiar charm or virtue. Some advertisers, not necessarily in the motor line, have ruined their chances of success by publishing abroad their own likeness. We often enjoy more fully goods, as also literary or poetic work, when we have not seen and do not know the manufacturer or author. Some geniuses in the factory and at the desk are insignificant to the eye. Nature, at times sparing in her natural and physical gifts, has bestowed vast stores of mental ability upon her unbeautiful children.

"An advertisement may be both attractive and pleasing. There are some we have turned to again and again simply because the illustration took pleasurable hold upon us, and, unconsciously, we became favorably disposed toward the thing itself. High art has been enlisted in this work of advertising, and a sense of gratitude toward the advertiser has led to the use of his—possibly—inferior goods to the complete exclusion of better things unhappily proclaimed.

"There are firms who cling to the idea that antiquity is still a virtue in the market, and largely declare their goods "The Original," even going to the extent of naming the date of birth or the age of the thing described; and the public, knowing that it is experience which teaches the most useful lessons of all, and that a hundred minds are ever busy in a more or less successful effort to improve upon any commodity which has attained to favor, prefer goods of the same kind whose making has no marks of antiquity.

"What's in a name?" is a stereotyped question; but there is more in the naming of an article than some makers think. It would not be a difficult task to draw up a fairly long list of articles which one would not care to ask for simply because their names are awkward or foolish. Give a thing a simple, straightforward, harmonious name and the battle is at least partly won. When people are uncertain how a word is to be pronounced, they hesitate to use it; and if that word be a foreign word, whose mispronunciation would be a mark of lack of education, educated people will shun it, even though it mean inconvenience and disadvantage to themselves, for fear of a slip.

"A man's own name is not by any means necessarily suitable for his goods. Who would not hesitate to inquire about the "Mary Ann carbureter" or the "Simple Simon tire?" The failure to appreciate things aright—a failure which is disastrous from the sale point of view—is shown in such nomenclature as the "Little Nell motor clog" or the "Tiny Tim differential grease." These may be fantastic exaggerations, but they have their counterpart in the advertisement pages of some journals.

"What the buyer really wants to know is the need that the goods will meet, claims that have borne the test, while one is also willing to accept with the usual scepticism the ambitious expectations of the makers. These have, however, been carried to such an extreme that the inquiry columns of many papers are full of requests for the experiences of disinterested users as to whether the advertised commodities actually fulfill the promise or claim of the advertisement.

State the Price

"One thing more, and that is the price. Why cannot advertisers state the price of their goods? The withholding of this all-important factor is undoubtedly detrimental to the salesman. It creates suspicion. It is said that many shop windows show no prices on their goods because the sellers vary the price according to the apparent spending ability of the customer, or because the instructions are to ask at first too much in order to secure custom by reduction. These methods will not do to-day. We want to know exactly what a thing is to cost; we shall then know whether it will be worth our while to buy. The bartering of the Eastern fair is not according to the genius of the Western buyer. Advertisements count, advertising largely controls the market; but, after all, it is worth that wins, and the advertiser who gains a large sale by fraud or deception will suffer for it in the end."

Should Use More Female Labor

Automobile Manufacture Comprises Many Operations Which Can Be Performed Equally as Well as by Men —Hours Should be Shorter and Pay a Little Lower

By H. W. Allingham*

Cutting a large square thread

THERE are, in automobile manufacturing, many lighter jobs which could be done quite as well by women as by men. Such work should be paid for at a higher rate than it has been the practice to pay for woman labor, but at a slightly lower rate than men would expect for the same work, and the woman's hours should be a little shorter, perhaps 44 hr. a week where the men work 48 hr.

In showing how the above decisions have been arrived at it will not be possible to avoid repeating much which has already been published in the daily press and in weekly and monthly magazines. It is, also, not proposed to attempt to argue that the automobile industry is more suited to the employment of female labor than any of the other industries at present employing male labor almost exclusively. In fact, all the arguments which may be put forward in favor of the employment of women in the automobile industry, apply with equal force to a large proportion of the world's industries.

Until the European war forced upon the European nations a careful consideration of the possibilities of employing women, it had been the custom there, as it is at the present time here, to assume that certain classes of work were "men's work," simply because men had been customarily employed on such work since its inception.

A consideration of the question as to whether such an assumption is based on any logical reasoning shows that in the majority of instances it is not. Whether work is suitable for female labor or not is dependent on two main considerations.

(1) The manual effort required.

(2) The skill required.

Consideration of 1 needs no amplification. 2 should be analyzed further. In general it has been found that the more skilled manual work of the world must be planned on the assumption that male labor will do it. The reasons for this are as follows:

a. By virtue of the skill required, a more or less lengthy period of apprenticeship is required, during with the worker is an expense rather than a dividend-earner. It therefore follows that it is desirable to employ such people on skilled work as may be reasonably expected to remain active producers for a large part of their lives. This rules out women in general, because of the belief that they are more uncertain than men, practically never working after they marry.

b. Ever since the inception of the "factory" systems less than 100 years ago men have banded themselves into unions which have tended to limit the employment of women, and of unskilled or semiskilled men.

Mechanical engineering, covering foundry, machine shops, etc., has, in the past, almost without exception been looked upon as work suitable for men, although in the specialized industries, more particularly in the higher branches, women have been employed regularly for many years. Examples of this are light brass-finishing, core making, etc., while in the electrical trades much of the light work is now looked upon as women's work. The real difficulty is to determine how far it can be extended. For example, there can be no two opinions as to the fact that the machining of a 6-in. shell weighing 140 lb. is not suitable work for women, from the point of view of manual effort required, although it may be from the point of view of skill.

Performing surface grinding operation

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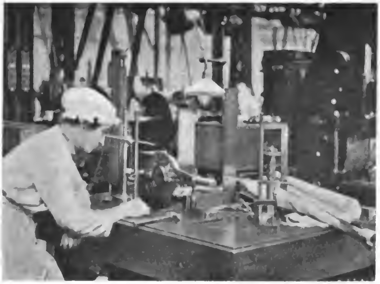
*Mr. Allingham is a consulting production engineer with a very wide experience both in Europe and in America. He is especially well acquainted with the automobile factories of America and of England, while he has been able to study at first hand much of the work now being done by women in Europe.



Extremes of work. Above, the operator is illustrated engaged in marking off, and at the right in handling heavy parts

Again the operation of high-speed-steel hardening furnaces, or relieving lathes, can scarcely be expected to be sufficiently standardized, except in occasional instances, to be suitable for female labor. Nevertheless the writer in his own factories has been agreeably surprised to find women handled all the above work with every success, after careful teaching. The strictly logical line to follow would appear to be, firstly to determine what may be considered the limit for a woman in regard to manual labor, and then it becomes a question of balancing up the objections of trades unions and the difficulties of teaching.

Overcoming Objections

As an example of how male workers may be handled in this connection, I will give an instance which occurred in a factory where I was production engineer some 5 years ago. The department in question was the manufacturing milling department, and the labor regularly employed was of the semi-skilled or "machine operator" variety. Some of the work had increased in volume very greatly, and we had put in jigs holding, say, fifty small pieces, one jig being filled while the other was cutting. The work was light, and labor was scarce. Realizing that to start girls on these machines would be an innovation at that particular shop, and likely to cause trouble, I called a meeting of all the men involved, and asked them what their objections would be. They had all the usual objections and, of course, said they would not work if women were introduced. I went in detail into the orders in the department and through the capacities of the machines as shown by stop-watch time-studies (already this practice for setting rates was accepted by the men) and gave them one week to bring in their male friends to man the machines. If they could not give us the output required then, we should have the right to start women, *giving the preference to the men's sisters and friends*. The result was twelve women out of forty workers within a month, the women's work being carefully selected so as not to clash with the men's. No trouble was experienced and the men could not be rude or rough to their own relatives.

The average results of this and dozens of similar experiences can be set out briefly as helping to point the way to future developments. 1. Women will handle small delicate work of a repetition nature more quickly than men, giving a larger output per hour.

2. Women should work shorter hours than men. In general 8 hr. are quite enough, and a 44-hr. week, with Saturday a half day is my present ideal, just as the 48-hr. week is long enough for men working at an efficient speed.

3. The task per hour for women on light work should be as high as for men.

4. Rather heavier work can be tackled by women at a rather lower speed per hour.

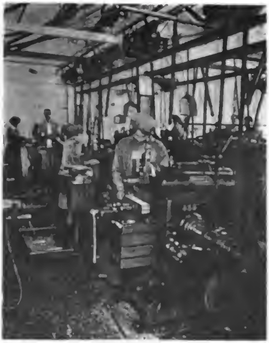
It is doubtful, however, whether the need for women to undertake what I describe as rather heavier work would arise if they were regularly employed on light work. There is so much light work in the world at present done by men that this, at any rate, merits the first consideration. For instance, the custom in some countries of using women for snagging and fettling castings while men are doing plain light engine-lathe work in the same factory, seems to be quite wrong. The great increase in quantity production in the automobile trade has caused a splitting up of operations, and a state of standardization of small operations has been reached in many factories to such an extent that workers entirely unfamiliar with factory methods can learn to perform the operations quickly and skillfully in a very short time. When these operations are light and do not involve much strength, there would seem to be no logical reason why men should be employed in preference to women. Such operations include almost all the light machining operations on such parts for instance as valves, aluminum pistons, etc., and light assembling operations on units.

Light Machine Work Suitable

The classes of machines capable of being efficiently operated by women are the lighter varieties of drills, milling machines, plain lathes, punch presses, special continuous operation machines and hand screw machines; automatics are not among those recommended to be considered at first.

In regard to assembling, much of the electrical work and top making is now being done by women, and the extension of women to the other components would appear a logical step. For example, the assembling of the connecting rod and piston, of pumps, of carbureters, even of the differential gear and steering gear, would not on the face of it appear to afford any difficulties.

The question of the reduction of wages paid is an economic one, but must be mentioned here, as it will be one of the great



Women operators doing what was formerly men's work, shaping small parts and grinding in valves of truck engines

causes of objection to women labor on the part of the labor unions. The fact that women have received lower hourly wages in the past has been due to the fact that so large a proportion of female workers have not been entirely dependent on their wages, and also that a very much smaller percentage of women than of men have dependents on them. Thus a girl of 18, one of a family, goes out to work. She is living at home, and a wage of $7 a week is almost all pocket money to her and she would not trouble to join a union if there was one. From the above, many people argue that it is quite logical that women should receive lower wages than men, because wages are dependent on supply and demand.

It is this same supply and demand which has caused the writing of the present article. The supply of male labor is unable to meet the demand. This has caused the wages offered to increase out of proportion to the increase in the cost of living, but still we have the alternatives:

(A) Curtail output
(B) Employ women

(a) is unsound from every economic standpoint because it is tantamount to limiting the production of wealth. We are therefore driven to adopt (b).

Now comes the question: Is it best for the country at large that where male labor is replaced by female labor, the wages, or piece work prices, shall be the same as previously, in which case the costs will remain the same, or shall the wages be in accordance with wages paid to women doing work requiring similar physical and mental ability in other trades? If we pay the same wages as men, we may embarrass all the other industries employing women, while if we pay wages similar to those in other industries we cause dissatisfaction to the men previously doing the work.

Must Compromise

The writer's belief is that a compromise will be effected. The wages paid at present for semi-skilled or un-skilled work are proportionately higher than those paid for the highly skilled tool-makers, for example. The reason for this is that the semi-skilled work has been increasing at such a rate that operators could not be obtained without offering big rates. If the semi-skilled work be now subdivided into light and heavy, we can leave the rates for heavy as they are now, and the light work should be logically somewhat lower-priced. In addition, the total wages earned by a woman are reduced, if she works shorter hours than a man, as she should do.

On the other hand, I believe wages paid to women in the past have been lower than they should be, and the widow who has been compelled to try and keep her family on the wages she could earn has been in an almost impossible position.

To sum up; automobile manufacture has expanded so much of late that there is a distinct tendency to a shortage of semi-skilled labor. There are many branches of the work at present done by men which could just as well be handled by women. Women should work shorter hours than the men previously employed on the work. Wages should be slightly lower than those received by men, but not so low as were customary before the war. Finally, present war wages should not be taken as a criterion, although the shortage of male labor will continue after the war.

Women employed in an English factory fitting crankcases of large aviation engines. They are very successful at work of this character

Committees Manage Perfection Spring Co.

System Eliminates Individual Management of Departments—Administrative Committee Supervises the Other Twelve—Each Committee Meets at Least Once a Month—Duties Outlined

THE Perfection Spring Co., Cleveland, one of the largest spring producers, is operating its institution under a form of committee management installed during the past year as briefly mentioned in THE AUTOMOBILE several weeks ago. The system aims to eliminate individual management of each separate department and to substitute for it a supervision of the various departments by means of committees composed of officers and employees and arranged and controlled by the administration.

The administrative committee includes Christian Girl, president and general manager; W. E. Perrine, assistant general manager; P. A. Connolly, secretary; T. E. Borton, treasurer, and H. H. Newsom, works manager, and is the supervising committee over all, determining the other committees, their responsibility, range of supervision and the departments directly under their control.

There are in all thirteen committees which are classified as administrative, finance, sales, manufacturing, engineering, standard engineering, purchasing, safety, welfare and employment, patent, salaries, sport and recreation, and cost and efficiency. Their range of duties and composition are:

Administrative Committee—

Officers of company—Supervision of all committees.

Committee on Sales—

Sales department and road engineering department—reports directly to the president or assistant general manager.

Chairman—the president.

Committee on Manufacturing—

President, assistant, general manager and works manager—supervises standard manufacturing and new process and development work and reports directly to president or assistant general manager.

Detail prints and schedules for manufacturing shall be given the manufacturing department by the order department. This department shall have charge of the cost department with the chief cost clerk as its present head. Stock room and receiving department are under the direction of the manufacturing department. It shall handle all stock and tools entering into the production of springs.

Chairman—the works manager.

Committees on Engineering—

Research committee, standard engineering committee.

Research committee includes designing and analysis—consists of the head of the laboratory, head of the experimental spring department and others that the chairman might desire.

Standard engineering committee has as its duties the active work of designing springs in process of manufacture—consists of chief engineer, road engineers and inside engineers and reports directly to J. G. Utz, chief engineer.

Chairman—the chief engineer.

Committee on Purchases—

Composed of assistant general manager, secretary and works manager. Has as duties the purchasing and directions of all purchases. The purchasing department is in charge of Mr. Homan who is directly responsible to the committee. The department has one man assigned to the purchase of factory supplies and tools for the manufacturing department.

Chairman—Assistant general manager.

Committee on Safety, Welfare and Employment—

Composed of the secretary, assistant general manager and works manager.

It is the duty of the committee to take such action as will safeguard employees and eliminate or reduce accidents to a minimum.

The committee on welfare will assist and look after the welfare of employees and their families.

Employment committee shall pass upon and handle such employment problems as come outside the scope of the regular employment agent.

Chairman—The secretary of the company.

Committee on Patents—

Composed of officers of company and engineers.

Its duties are the supervision of the application and prosecution of matters referring to patents and the investigation of all patents submitted from outside sources to the company with the power to recommend purchase or rejection. Patent attorney expense is authorized by this committee and invoices audited by it. Patent department is in charge of the chief engineer who reports to the committee.

Chairman—The chief engineer.

Committee on Salaries—

Composed of president, secretary and assistant general manager.

Duties to handle all matters pertaining to salaries.

Chairman—The president of the company.

Committee on Sport and Recreation—

Consists of assistant general manager, secretary and works manager, and also the manager and assistant manager of each team.

Duties consist of arrangement for every kind of recreation such as baseball, bowling and other features which are financed by the company.

Chairman—The works manager.

Committee on Cost and Efficiency—

Composed of works manager, assistant general manager, secretary and two employees.

Duties consist of investigation into costs and efficiency systems.

Chairman—The works manager.

The president and assistant general manager are members ex-officio of all committees whether mentioned or not.

Any committee may appoint a sub-committee upon approval by the president or assistant general manager and all committees are governed by the general executive committee composed of the assistant general manager, who acts as chairman, and the sales manager, chairman of the engineering committee, chairman of the manufacturing committee and the chairman of the finance committee. It has charge of the execution of all matters pertaining to the sale and manufacture of the company's product as directed by the policy of the board of directors, which is represented by the president.

Each committee meets at least once a month and as much oftener as the chairman of the committee may demand.

System Is Satisfactory

The committee system has been in operation for several months and up to the present is giving excellent satisfaction. Many advantages have accrued including broader consideration of factory matters, elimination of any personal favor that might possibly arise in the purchasing department, rapid determination of a balanced stock by the purchasing committee which thus permits placing purchase specifications for exact requirements when needed and avoids overstocking of material, increased and improved production, and economy.

The co-operation of the heads of departments working together in committee, thus effecting co-ordination of effort, is believed, by the company, to have produced maximum results with a minimum degree of labor.

Care has been taken not to destroy any of the good effects to be secured by decisions which are the result of careful study and analysis of the members of the different committees by a rule which forbids any employee of the company except the president or assistant general manager to change or cancel any decisions as rendered by a committee without first consulting the chairman of that committee. If in his opinion the change is of minor importance and not sufficiently of consequence to require a committee meeting he may authorize the change over his signature. Or if the suggested change is for betterment and is important he may submit it at once to the committee, as for example if a road engineer should attempt to change the design of any spring after the design has been approved by the engineering committee, he must first consult the chairman of that committee.

Final Salary Decision

No department head is allowed to promise or file application for an increase in salary without first consulting the chairman of the salary committee. And as an added assurance to the perfect operation of the system, and in order to place the responsibility for its conduct upon an individual, the chairman of the executive committee, the assistant general manager of the company, is given the veto power and final decision in all matters.

Thermoid Disk Coupling Replaces Steel

THE recent growth in popularity of fabric couplings immediately suggests the question as to why this material should be more satisfactory than steel. It will permit of a slight disalignment of the running parts, it is true, but so will a steel disk coupling, and yet steel has been replaced by the fabric in more than one instance.

A case in point occurred at the Mercer plant during the spring of 1914, when the present model 22-70 was being developed. E. H. Delling, who was at that time chief engineer of the Mercer company, was developing the experimental chassis. Originally the car was fitted with a large diameter flexible leather coupling between the clutch and the gearset, taking up all the play between the engine shaft and the main shaft of the gearbox.

Changes in the gear in the gearbox and the propeller shaft brake which was added necessitated a different type of joint in place of the leather. The leather had to be abandoned, as it was found that with the stresses that were added with the propeller shaft brake, it would not be strong enough in the small diameter that was required.

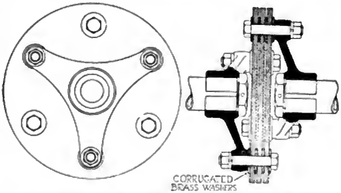
The three leather disks were replaced by two thin leaves of tempered saw steel on six or eight cars as an experiment. It was known that the strength of these leaves would be ample, but the uncertain part of the coupling was its action in practice and very soon after they were put on it developed that a rattle would occur. It took several days to locate this, as nobody suspected the coupling which was solidly bolted together. What made it particularly puzzling was the fact that the rattle would occur generally on direct drive and especially when running light or coasting. There was one peculiar feature and that is the rattle would never occur until the car had been run for 10 or 15 min.

The steel disks in the coupling were finally suspected, and to determine if they were really at fault they were removed and a fabric disk coupling made by the Thermoid Rubber Co. was substituted. Immediately the rattle ceased, and as a result of these experiments all the Mercer 1915 as well as the 1916 and 1917 cars were equipped with the Thermoid Hardy disks.

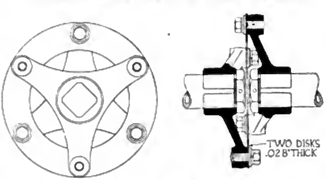
The laminated steel disk coupling which had to be abandoned is shown in the accompanying drawing. A three-armed dog is used on each shaft as a flange member and so arranged that the flange arms are bolted alternately between the arms of the flange on the opposite shaft. The flange members are secured to the shafts by squared ends and bolts which fit upon the ends of the shafts.

An investigation into what could have caused the noise in a coupling of this nature showed that it was due to a slight misalignment between the crankshaft and the mainshaft of the gearbox. This would cause a flexure in and out of the disks, similar to the action of a hand in pressing the bottom of an oil can, or in the disk devices that are used as a diaphragm in noise-making instruments. This in turn would transmit a torsional vibration to the gearset pinion whose teeth would naturally vibrate against the teeth of the countershaft gear, the clearance between the teeth being 0.004 in. The rattle would not show up for the first 10 or 15 min. until the grease would soften and cease to act as a cushion. After a little running the grease would thin out and thereafter the noise would be heard.

The Thermoid Hardy disks which replaced those of saw-steel are made under a patented process, of cross layers of high grade cotton fabric with rubber between them, and they are cured under compression similar to a tire. Their tensile strength is very high and is higher than that of leather as tests at the Columbia University have shown that couplings of the design illustrated which were worked out by E. H. Delling have withstood a torque of 21,000 inch-pounds before fracture.



Thermoid Hardy disk coupling for driveshaft mounting



Saw-steel disk coupling which was found to rattle

The Rostrum

Door Spring as Aid in Assembling

EDITOR THE AUTOMOBILE:—A few years ago when automobiles were built with the cylinders cast separately, it was not much trouble for two men to replace the cylinders after removing them. Now we have cylinders cast in blocks of from two to six and also piston rings with two and three parts, making it almost impossible for two men to assemble a motor, unless in an up-to-date shop, with all of the latest tools at hand.

For the benefit of those who have experienced trouble in entering the piston rings in a block of cylinders, where two or more pistons are entering at once, the best helper is a ⅜-in. screen door spring. Cut the spring into lengths, which, when stretched tight around the piston, will ride down with the cylinder, driving the rings into place without any trouble. The springs can be easily removed and used over, as soon as they have served their purpose on each piston.

Trenton, N. J. F. F. PALMER.

Data on Mean Effective Pressure

Editor THE AUTOMOBILE:—What is the brake mean effective pressure or the mean effective pressure of an internal combustion engine?

2—How can this be determined?

3—What is the pressure on the latest cars?

Orange, Cal. A. W.

—At the instant of explosion the pressure is very high and falls as the piston descends. The mean effective pressure is the average of the pressure existing throughout the firing stroke. Since a certain amount of power is used up within the engine and by friction the actual power delivered at the flywheel is less than it would be if figures from knowledge of what the mean effective pressure really is. We therefore take the mean effective pressure and multiply it by a decimal representing the percentage efficiency of the engine. Thus if the actual mean effective pressure is 100 and the mechanical efficiency 75 then the brake mean effective pressure would be 75 lb. per. sq. in. In actual engines this brake mean effective pressure varies between 60 and 100 lb.

2—When a horsepower test has been made the actual power delivered at a stated number of revolutions is none. We know this power comes from so many strokes of the pistons and of the impulse of the explosions. Knowing the area of the piston head and the length of the stroke we therefore know the brake mean effective pressure.

3—Answered under 1.

Troubled by Axle Shafts Breaking

Editor THE AUTOMOBILE:—I have a 30-hp. car with a semi-floating rear axle; the axle shafts are 1 5/16 in. diameter and at outer ends run in roller bearings which have a hardened steel sleeve 1¾ in. outside diameter, 1 5/16 plus bore which slips over the axle shaft and forms a bearing or inner race for the rollers.

The axle shafts frequently break off short at inner end of outer bearing and to remedy this I intend to have vanadium steel shafts made 1¾ in. diameter, dispense with the inner race of bearing and let the axle shaft run on the rollers. The rollers are of the high duty type and only about 2 in. long, so it is probable that the rollers would cut the shaft bad enough in a few thousand miles to require the replacement of the shaft.

Will it be safe and proper to case-harden the outer end of the axle shaft? I intend to do this by heating the outer end of the axle red hot in a bath of melted cyanide. Do you know of a better method? How long should the axle be left in the cyanide bath?

Should the axle be plunged in water after taking out of the cyanide?

My car is a 1913 Reo and it is easy to make the change in size of axle shaft without any large changes in the axle housing.

Carthage, Mo. F. B. N.

—You should have no difficulty in repairing the axle in the way you suggest. It would probably be unwise, however, to attempt to harden the vanadium steel shaft by the method you mention as this will almost certainly make the end very brittle. You do not say whether you are equipped for accurate heat treatment. Suppose you used a 0.3 or 0.4 carbon chrome vanadium steel, this should be quenched at 1650 deg. Fahr. and drawn at 850 deg. Fahr. The shaft should be gradually tapered from the back of the bearing down to the place where it fits in the differential hub. A somewhat easier heat treatment perhaps would be available if you used 3½ per cent nickel steel of a 0.3 to 0.35 carbon, allowing this to cool slowly after forging, heating then to 1550 deg. Fahr., quenched in order to reheat to about 650 deg. Fahr., allowing it to cool slowly in the air after this last heating.

Wiring Diagram of Wagner System

Editor THE AUTOMOBILE:—Kindly give wiring diagram of Wagner 12-volt starting and lighting system on 1913 Moon 48 roadster.

Wilmington, N. C. R. W. M.

—Wiring diagram of Wagner 12-volt starting and lighting system used on 1913 Moon is illustrated in Fig. 1.

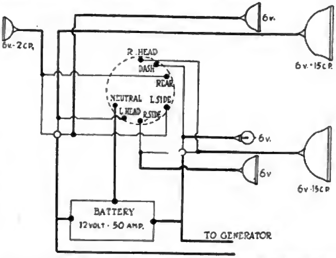
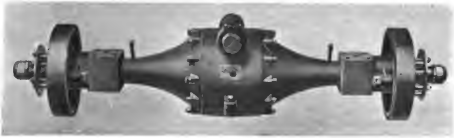


Fig. 1—Wiring diagram of Wagner 12-volt starting and lighting system on 1913 Moon 48 roadster

Empire 1-Ton Axle Has No Differential



The new 1-ton worm-driven axle made by the Empire Axle Co., Dunkirk, N. Y. It is characterized by the fact that it has no differential and is the first stock axle to be so offered on the market in this country. The housing is of the three-piece type, following previous Empire practice. The central part of the housing carries the worm and wheel as a complete unit

Central Part of Three-piece Housing on New Truck Type Carries Worm—Brake Shafts Oiled from Inside

NO differential is fitted in the new 1-ton worm-driven truck axle just brought out by the Empire Axle Co., Dunkirk, N. Y. This is the outstanding feature of the new axle, which was designed primarily for use by trucks of 1-ton capacity to sell at less than $1,000 and for converting passenger-car chassis into trucks of 1-ton burden. It is the only stock worm-driven axle so far to be placed on the market in which the almost universally adopted differential has been eliminated.

Advantages claimed for the use of a solid axle without a differential are that better traction is obtained over snow and bad roads, less tendency toward skidding when the brakes are applied, greater tire mileage and an appreciable reduction in the weight of the axle assembly itself.

The elimination of the differential enables a live axle to be used which is sufficiently strong to carry the weight and take the drive. This means that the casing for the worm gear need only be strong enough to support the driving stresses without any weight-carrying function. The elimination of the differential and the resultant decrease in the weight of the necessary housing makes the new axle light and simple.

The axle is designed to take both the propulsion and the torque through the springs, and is provided with a three-piece housing which follows previous Empire design. The center housing carries the worm and the worm wheel as a complete unit.

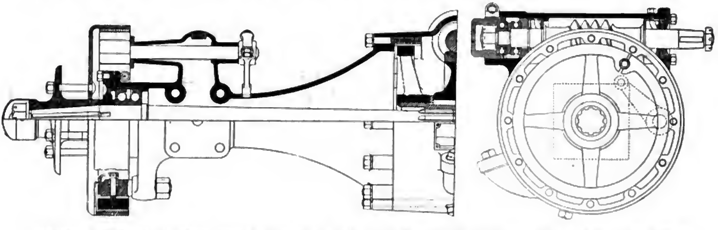
As shown in the sectional view, the complete housing is open from end to end and is characterized by a new construction in which the brakeshaft bracket is hollow and in open communication with the interior of the remainder of the housing, thus insuring the brakeshafts a sufficient quantity of oil for lubrication.

The worm and worm wheel are of the straight type. The worm is of 3½ per cent nickel steel, case-hardened and then ground to the correct tooth form. The worm wheel is cast from special phosphor bronze of high tensile strength. It is cut by the hobbing process, thus producing a generated tooth.

The driveshafts are of chrome nickel steel, heat-treated and ground to size. They are of the three-quarter floating type and are supported at the wheel ends on double-row radial-and-thrust type ball bearings, as is shown in the left of the section. As shown at the right of the section, the worm thrust is taken by double heavy-duty ball thrust bearings and the radial loads by two roller bearings of the Hyatt type.

The brakes are internal-expanding, with drums 13½ in. in diameter and 2¼ in. wide. The spring pads, which are integral with the side housings, are cubical in shape and hollow, forming the open interior connection between the housing proper and the brakeshaft supports. The spring centers are 38 in. apart, and are designed for springs 2½ in. wide.

The tread of the axle is 56 in. and the ratio between the worm and the worm wheel is 7.2 to 1. The axle is designed for a rated load of 3550 lb. on the tires, including chassis, body and live load.



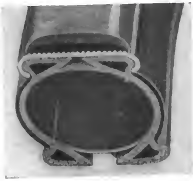
Longitudinal half section and section through the worm carrier of the new Empire 1-ton axle which has no differential and which is designed for use on trucks of that capacity to sell at less than $1,000. Note that the spring pads are cubical and hollow, and that the brake shafts are lubricated from within the housing through the open communicating passage formed by the hollow spring pads. Also note the straight worm and how it is carried on thrust ball bearings and straight roller bearings for the radial load. The axle is of the three-fourths floating type, mounted on double-row radial-and-thrust type ball bearings at the wheel ends

ACCESSORIES

Big 4 Tire

SEVERAL radical departures from conventional tire construction embodied in the Big 4 include construction in three parts, any one of which may be replaced if damaged, unusually low air pressure required and, according to the manufacturer, positive puncture-proof and well-nigh trouble-proof qualities. The tire consists of two side walls and a non-skid tread rim, an idea of the construction in which these units are assembled being given in the accompanying illustration. With this tire it is necessary to carry only spare side walls and tubes instead of complete spare tires. The tread rim is claimed to be exceedingly durable and the replacement of the tread or one or both of the side walls is much less expensive than to buy a new tire. Only 25 lb. pressure is required for a 34 by 4-in. size, as compared with 80 lb. for an ordinary tire of these dimensions.

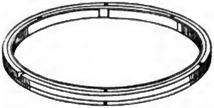
The company also manufactures tires for truck use which are claimed to give the same high resiliency as the ordinary pneumatic tire and also the uninterrupted service and durability as the solid type. A non-skid tread rim is also made for winter service on the truck tires. —Big 4 Tire and Rubber Co., Cleveland, Ohio.



Section through Big 4 tire, showing the two side walls and the tread rim

Chopa Piston Ring

This is a compound gray iron piston ring made of several sections overlapping in a manner said to prevent leakage. Because of the compound construction an even pressure is exerted on the cylinder walls and the ring will accommodate itself to worn pistons, it is claimed. Price, each, 3¾ in. diameter or under, $1; 4¾ in. and under, $1.25; 5¾ in. and under, $1.50.—Chopa Piston Ring Co., 264 East Jefferson Avenue, Detroit.



Chopa compound piston ring

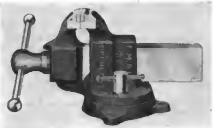
Pillsbury Hubpul

This is a combination hubcap, wheel puller and a device for pulling the car out of mud holes. It is made exclusively for Ford and Model 490 Chevrolet cars. The hub pull is quickly attached to each rear wheel of either of the cars above mentioned by simply unscrewing the original hubcap and inserting the device in its place. It may be left on permanently if desired, and, as it is neatly designed and nickel-plated, does not detract from the car's appearance.

The rubber-covered special hooks which attach to a rope are hooked around the spokes the rope wrapped once around the hub, then carried forward or backward from the underside and anchored to a stake, telephone pole, tree, post or any stationary object; the motor is then started and the wheels slipping causes the cable to be wound, which pulls the car gradually out with much greater leverage than could be obtained with the motor on ordinary traction. The device may also be used for removing wheels from the rear axle without stripping threads. The price per set is $6.—Pillsbury Mfg. Co., Minneapolis, Minn.

Fulton Machinists' Vise

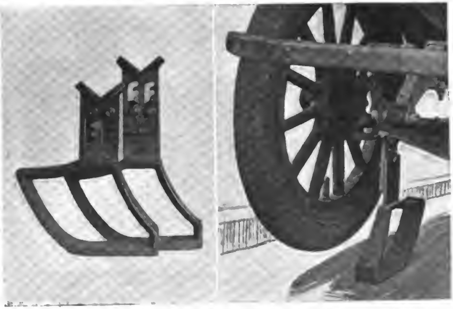
This light weight swivel base vise is suitable for the repair shop. The jaws are cast steel welded onto the face of the vise, giving a very strong construction. The vise may be swiveled to any desired position and firmly locked by a taper head bolt. Price, No. 295, with 3-in. jaws, $7.50; No. 31, with 4-in. jaws, $10.50.—Fulton Machine & Vise Co., Lowville, N. Y.



Fulton Peerless machinists' vise

Rotary Jack

As shown in the illustration, this jack is inserted under the axle and the car driven ahead slightly so that the axle and wheel are automatically lifted up on the jack which is built on the rotary lever principle. The device is composed of two main parts together with an adjustable pillar for axles of different heights. The jack is made of malleable iron and weighs 7 lb. It sells for $2.50. —Rotary Jack Mfg. Co., 340 Moore Building, San Antonio, Tex.



Left—Two views of the Rotary jack, showing upper and lower extreme adjustments. Right—Rotary jack in use under a car axle

Waynelight Headlight Regulator

The Waynelight is a small transformer designed to steady the headlight illumination of Ford cars. The current passes from the magneto through the transformer to the lamps, which are wired in multiple. Such wiring prevents the possibility of both lamps going out, as is the case with the usual series winding. It is claimed that the transformer furnishes a steady light at all speeds above 10 m.p.h. The installation is simple, it being only necessary to substitute 6-volt lamps in place of 9-volt lamps, attach the present headlight wire to one of the magneto terminals of the transformer, and ground the other transformer terminal to the frame. A pair of wires, each connected to a lamp, extend to the two lamp terminals of the transformer. The Waynelight may be placed on the dash, under the hood or floorboards, or wherever it is most convenient. Price, $3.65.—General Electric Co., Fort Wayne, Ind.

Spotlight Push Switch

This push-button switch placed in the neck of the spotlight permits the hand that directs the rays to also control the current. Two buttons project from the switch—one black and one white. Pressure on the white button causes the lamp to light, if out; the black button is used to shut the lamp off. The switch is insulated by means of a fiber sleeve, and the push-buttons are put in place in the switch after it has been placed in the small neck of the lamp.—Cutler-Hammer Mfg. Co., Milwaukee, Wis.

Compound Air Compressor

Air is taken into the large cylinder of this twin-cylinder air-cooled air compressor and compressed to about 50 lb. per square inch; at this pressure, and at about one-quarter of its original volume, it is delivered to the small or high-pressure cylinder, which compresses it to its final pressure. This system is claimed to give higher efficiency, to require less power and to reduce the wear on the parts. Belt drive is used, either from a general power line or directly from a motor. In this last case the motor is mounted on four uprights at the top of the compressor, making a very compact arrangement. Complete installations, including steel air-storage tanks of any capacity, are handled.—United Engine & Mfg. Co., Hanover, Pa.

Utility Luggage Lock

Luggage may be locked to the robe-rail or foot-rest with this lock. Two steel fingers may be closed together and locked, securing the articles to the car. For example, gloves or coats may be clamped to the steering wheel, a suitcase may be locked to the foot-rest or the control levers may be fastened to the steering-wheel quadrant, thus preventing the theft of the car. Two keys are supplied with each lock. Price, $1.—Backus Novelty Co., Smetheport, Pa.

Badger Spring Bumper

The Badger two-piece spring steel bumper is designed for indestructibility and may be fitted to almost any car. The cross-bar is made of high quality spring steel specially tempered, though very resilent to cushion a shock, is sufficiently stiff to protect the parts. The bar may be adjusted to any angle desired. Price, $12 with 2-in. nickel bar; $10.50 with black bar.—Auto Parts Mfg. Co., Chicago, Ill.

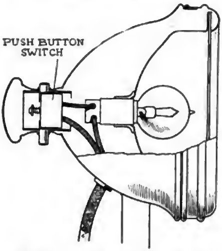
E. & S. Towing Truck

This is a wrecking truck that may be clamped beneath the axle, thus supporting the car and permitting it to be towed in. Two 14-in. wheels with an 18-in. tread are mounted on a malleable iron frame that has an adjustable upright clamp that may be bolted to the axle. Two towing poles are included, one 10 ft. long for a rear axle break, and one 5 ft. long for front axles. All bearings have grease cups and the total weight is 160 lb. Price, $27.50.—Ellis-Smith Mfg. Co., Buffalo, N. Y.

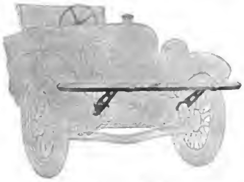
Edison Lamp Assortment

A display box of assorted sizes of Edison Mazda lamps has been brought out to aid dealers in their sales work. The assortment is the minimum stock which any dealer should carry and will enable him to meet the lamp requirements of 90 per cent of all the gasoline and electric cars for 1914, 1915 and 1916. The lamps are arranged in an attractive container and a list of the lamps carried is printed on the cover of the container.—Edison Lamp Works of General Electric Co., Harrison, N. J.

Backus Utility baggage lock

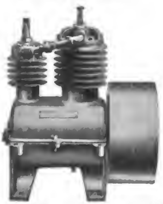


Cutler-Hammer push button switch for spotlights, showing connections and mounting in the lamp

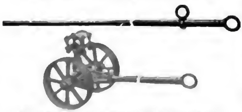


Badger two-piece spring bumper

Waynelite transformer for Ford headlights



Compound twin-cylinder air compressor



E. & S. wrecking truck for clamping underneath the axle of a disabled car for the purpose of towing

Industrial Miscellany

Factory

Jenkins Machine Co., Sheboygan, Wis., has been purchased from W. W. and Louis Wolff by A. G. Studeman, formerly an executive of the Falls Machine Co., Sheboygan Falls, Wis., and Mark Hoeper, until now assistant treasurer and purchasing agent of the J. I. Case Plow Co., Racine, Wis. The Jenkins company is capitalized at $70,000 and will not change its name or capital for the present.

Osborne Casting Co., Racine, Wis., recently organized, expects to take occupancy of its new 15-ton gray iron foundry on Jan. 1.

Burnell Fuel Saver Co., Milwaukee, Wis., has been organized by A. A. Giese and A. J. Melms to manufacture carburetion auxiliaries and similar appliances for the automobile trade. The capital stock is $10,000.

Nu-Way Puncture Cure Co., capital stock $20,000, has been organized in Green Bay, Wis., to manufacture a fibrous compound for automatically sealing punctures. R. C. Moore is the inventor. Offices have been opened at 403 West Walnut Street, Green Bay.

Four-Wheel Drive Auto Co., Clintonville, Wis., is spending approximately $20,000 in new tools and equipment for additions now being completed. It has a standing order for twenty trucks per week for an indefinite period, and is now producing four a day. By Jan. 1 the output is to be six a day.

Commercial Body Co., Trenton, N. J., manufacturer of bodies for automobiles, has acquired property at 809 South Broad Street for an addition to its plant.

Perfection Tire Co. will commence work soon on the erection of a plant at Niagara Falls, Ont., for the manufacture of tires and rubber goods.

Packard Motor Car Co. has acquired additional property in Long Island City, adjoining its present plant, on which it will erect an eight-story building, more than doubling its present facilities.

International Rubber Co., South Bend, Ind., maker of automobile tires, is pushing the erection of its new plant in this city. The building will be completed by Dec. 12. Half of the brickwork on the building, which will be 382 by 80 ft., is already done. The building with its equipment involves an expenditure of about $200,000. The plant is located on the Vandalia tracks and Edwin Boulevard, in the southern part of the city. The company has established 1500 selling branches.

H. W. Kardell, president of the Kardell Motor Car Co., plans to build a factory in Alton, Mo., to build a motor plow.

Simplex Automobile Co., New Brunswick, N. J., has opened the Simplex Recreation League. The old Middlesex Club house in Highland Park has been transformed into club quarters for its employees. The league was organized by the directors of the company for the benefit of the men who are employed at the plant and their families.

McCord Mfg. Co., Wyandotte, Mich., will build an addition.

R. H. Reynolds & Co., New Albany, Ind., is erecting an automobile woodstock plant, combining two factories now at Corydon and De Pauw, Ind.

Personal

J. K. Stewart, of the Stewart-Warner Speedometer Corp., Chicago, Ill., has purchased 2½ acres of ground on Jackson Avenue, Long Island City.

M. D. Randall heads the Randall Motors Corp., New York City, to handle the wholesale and retail distribution of the Grant.

G. F. Blake has been appointed district sales manager of the Auburn Ignition Mfg. Co., Auburn, N. Y., maker of the A. I. M. Auburn and Blazer spark plugs and valve lifters.

H. H. Cobe and **C. F. Coe** have joined the Burd High Compression Ring Co., Rockford, Ill., organization in Boston, Mass. Mr. Cobe has been in the automobile field since 1903, being connected with the Haynes, Locomobile, Jackson, Palmer Singer and G. & H. Carbureter Co.

W. J. McKechnie has been appointed general manager of the American Forging & Socket Co., Pontiac, Mich. He was for 4 years chief accountant of the Rutenber Motor Co., Marion, Ind. The American Forging & Socket Co. makes forgings and bow sockets for automobile makers.

C. E. Collard, formerly Philadelphia branch manager of the Chase Motor Truck Co., and C. N. Gillette, Southern division sales manager in the same organization, have both severed their connections with that company to become associated with the Selden Truck Sales Co., Rochester, N. Y. Mr. Collard becomes division sales manager in the Philadelphia territory, while Mr. Gillette assumes the same position in the Southern terri-

The Automobile Calendar

ASSOCIATIONS

Nov. 22—Boston, Mass., National Assn. of Automobile and Accessory Jobbers' Meeting.

Dec. 2-9—Electricians' Countrywide Celebration.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.

Nov. 16—New York City, S. A. E. Meeting.

Nov. 23—Philadelphia, Pa., S. A. E. Meeting.

CONTESTS

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.

Nov. 30—Uniontown, Pa., Speedway Race.

Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23—Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14—Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15—Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race, Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.

Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel I. R. Gates, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 6-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremoin, Secretary.

March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade tory, with headquarters at Charlotte, N. C.

J. F. Hill, who has been manager of the Splitdorf Service & Sales Co. branch at Kansas City, Mo., for the past 4 years, recently resigned his position and will open a garage business at Waterville, Me. His successor as manager at Kansas City is O. J. O'Donnell, recently with the Chicago office of the same company.

Newell Lyon, for 3 years general sales manager of New York State for the White Co., has been made manager of the Kansas City branch of the company, recently established after purchase of the Kansas City White Co. from J. H. Toole. Mr. Toole is now taking a vacation and his future plans are not announced, although he may be connected with the branch.

N. L. Le Blond, formerly secretary and general manager of the Hannibal Motor, Wagon & Body Co., Hannibal, Mo., has been made Western manager of the Dearborn Motor Truck Co. and will make his headquarters at Kansas City. Augustine Gilmore, formerly of Chicago, succeeds Mr. Le Blond in the Hannibal company as general manager, Miss Hattie Salee being made secretary.

A. D. Plughoff has resigned as vice-president and general manager of the Willys-Overland Co. of California and as vice-president of the Overland-Pacific, Inc. He is leaving San Francisco immediately for an extended trip through the Eastern factories before announcing his future plans. He has been connected with the automobile trade for 18 years, having been associated with J. W. Leavitt when he handled the Overland on the Pacific Coast.

W. L. Burgess, St. Louis, manager of the tire and tube department for the Dorris Motor Car Co., has resigned to become sales manager for the Sterns Tire & Tube Co., that city.

W. F. Kneip, manager of the Franklin Motor Car Co., Baltimore, Md., has been elected president of the Baltimore Automobile Dealers' Assn. C. H. Reeves, Jr., of the Foss-Hughes Co., was elected vice-president, and E. S. Bliven, of the Standard Motor Co., secretary and treasurer.

E. T. Backus, who came to Baltimore, Md., on Aug. 1 and assumed charge of the headquarters of the Ford Motor Co. in this city, has been appointed one of the three assistants to N. A. Hawkins, general sales manager of the Ford company, with headquarters at Detroit. Mr. Backus was in charge of the Ford branches in Dallas and Houston, Tex., before coming there. A. A. Grisham, assistant manager here, succeeds Mr. Backus as manager of the Baltimore headquarters. K. G. Harig, a Baltimorean, who was in charge of the State wholesale department, becomes assistant manager. H. W. Ford will be the successor in Mr. Harig's old place.

H. O. Foskitt has been placed in charge of the Jackson Motor Co. branch at Lawrence, Mass.

W. R. Dudley, St. Louis, manager of the Vesta Battery & Equipment Co., has been transferred to the Chicago branch as a traveler, and is succeeded by F. G. Fulkerson, formerly of Cleveland.

F. E. Miles has become purchasing agent of the Lewis Motor Corp., Detroit, Mich. Mr. Miles was formerly connected with The National Motor Vehicle Co.

Z. B. Leonard has resigned his position with The Perfection Spring Co., Cleveland, Ohio. He was formerly head of the laboratory.

Floyd Robinson of 251 Putnam Avenue, Detroit, advertising manager of the Regal Motor Car Co., Detroit, Mich., was seriously injured recently when he was struck by a motorcycle. His skull was fractured. Later reports are that Mr. Robinson's condition is much improved.

E. J. Warren, formerly general manager and treasurer of the Crosby Co., Bangor, Me., will open in January his new store, the Auto Supply & Rubber Co., on Post Office Square, with a full line of automobile accessories and rubber goods.

Dealers

Fisk Rubber Co., Philadelphia, has arranged to lease a four-story building which will shortly be erected at 664-66 North Broad Street at a cost of $100,000.

Henry A. Rowan, Jr., Co., 2036 Sansom Street, Philadelphia, has taken over the agency for the Smith Form-a-Truck.

Ramey Motors Co., Philadelphia agent for the Hal, has moved into its new showroom at Broad and Brown Streets.

Garwood Motor Car Co., 2248-52 Euclid Avenue, Cleveland, Ohio, has been organized to distribute the Pathfinder in northern Ohio.

J. R. Flannery, Jr., formerly of Stillman & Hoag, has entered into partnership with Wm. C. Brightly, Englewood, N. J., to conduct a garage and general machine shop under the name of Brightly & Flannery, Inc.

Standard-Racine Rubber Co., Oneida and Jefferson Streets, Milwaukee, distributer of Racine tires and a general line of accessories, will build a new tire and accessory store at Astor Street and Juneau Avenue, on a corner site measuring 175 by 135 ft. The present quarters will be continued as a general accessory and supply house.

Jesse A. Smith Auto Co., 215 Wisconsin Street, Milwaukee, State distributer of Hudson cars since 1911, has taken a long-term lease on the Welch garage building, Grand Avenue and Seventh Street, which has just been vacated by Harry Newman, Inc., former Chalmers distributer. It is one of the largest buildings in Milwaukee devoted exclusively to automobile distribution, being four stories high and containing nearly 50,000 sq. ft. of floor space.

Weber Implement & Automobile Co., St. Louis, Mo., has taken the Maxwell agency and the Brinkmann Motor Car Co. has withdrawn from business, its affairs being liquidated. Coincident with this, G. C. Brinkmann, former president of the Brinkmann Motor Car Co., filed a voluntary petition in bankruptcy in which his liabilities were given as $32,198 and his assets at $87, of which $5 was cash.

Aniser Mfg. Co., St. Joseph, Mo., has changed its name to the Mechanical Belt Co. and is now marketing the Crowe fan belts exclusively. This product will be sold through the jobber.

Willys-Overland Co. has opened a show and sales room at 71 Broadway, Yonkers, N. Y.

Motor Car Sales Co., Bloomington, Ill., has broken ground for a new garage. This structure will be located at 406-410 West Washington Street. The company will utilize the building as a sales agency for the Chalmers and Dodge.

J. W. Leigh Motors Co., St. Louis, has leased space in the Plaza Hotel building at 3302-3304 Locust Street as headquarters for the Apperson.

Paul Crawford, Birmingham, Ala., State agent for the Chandler, has opened his new salesroom at 406 Twenty-first Street.

Spangler-Tubbs Motor Co., Boston, has been formed to handle the Metz.

Stockyards Garage, Denver, is the name of a new business opened at East Forty-seventh Avenue and Lafayette Street to deal in accessories. The manager is A. J. Mosley.

Rocky Mountain Auto Sales Co., a new concern at 204 Sixteenth Street, distributer of Auburn cars and Gladiator tires for Colorado, Wyoming and part of Nebraska and South Dakota, has added the Regal distributing agency for Colorado and half of Wyoming.

Roberts Auto Co., Denver, Marmon distributer for Colorado and Wyoming, has moved from 220 Sixteenth Street into a new $20,000 building at 1231-1239 Broadway.

George H. Estabrook, Denver, is now the business name for the Briscoe and Hollier distributing agency for Colorado and Wyoming, formerly conducted as the Briscoe Auto Sales Co., of which Mr. Estabrook was president. The location is still 1646 Broadway.

Mulford Bros., Streator, Ill., have opened the old Halladay garage, corner of Kent and North Sterling Streets, and will carry on a general business in the repairing of automobiles and sale of supplies.

Tioga Automobile Co., Philadelphia Hupmobile dealer, has sold out to a firm headed by Robert McCormick, who was formerly in charge of sales for Hurley & Early, this city. The new company is looking around for larger quarters, and is at present located at 332 North Broad Street.

Richwine-Haines Co., Philadelphia, has leased the showroom at 719 North Broad Street, where it will handle the Liberty car. The territory includes Pennsylvania, New Jersey, Delaware and Maryland.

The Thomas-Bonner Co., accessories, electrical goods, etc., 152 Sixth Street, Milwaukee, has been released from bankruptcy litigation instituted in September. Creditors have caused the action to be dismissed and the business will be continued without interruption.

E. E. Williams and Clarence Heiderscheid, proprietors of the Kingdom Garage in Hardin, Ill., dissolved partnership, the former purchasing the interest of the latter. Mr. Heiderscheid remains in Hardin and will devote his time to the Ford car agency and service station. He has let the contract for a new garage and sales agency on Main Street.

Garber & Habecker, Washington, Ill., have dissolved partnership. The former will continue the garage and sales agency, while Mr. Habecker will occupy the W. H. Long building and will open a garage and sales agency of his own. Mr. Garber will continue to handle the Ford car, while the other lines previously handled by the firm will now be in charge of Habecker.

Moerschell Electric & Auto Supply Co., St. Louis, announced that H. E. Q. Kuhn, factory expert on Rayfield carbureters, has joined that company to handle Rayfield business.

National

HIGHWAY

Six and Twelve Cylinder Cars

You Get Them Both—

the buyers of Sixes and the buyers of Twelves when you are the National dealer.

Analyze the automobile industry and here is what you find; National last year was the fastest growing company building cars in the better-grade class; National built America's first stock Sixes; the success of National Sixes made possible the next great multi-cylinder improvement, the Twelve.

Motor experts have devoted sixteen consecutive years' work on National motors.

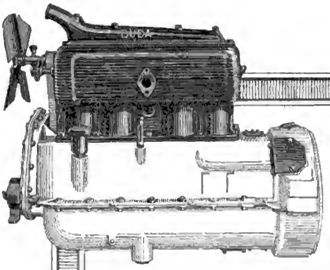
Furthermore, the Only One

Of all the leaders in the better-grade class, National is the only one, that offers this season, in addition to cars with "V-type" motors (Twelves) a line of successful six-cylinder cars.

GET BOTH BUYERS BY BECOMING
THE NATIONAL DEALER

Highway Six $1750 Highway Twelve $2150

National Motor Vehicle Company, Indianapolis
Sixteenth Successful Year



At last we can again promise

PROMPT DELIVERIES

INCREASED DEMAND for fine motors has kept us heavily oversold for months, in spite of energetic efforts to increase our capacity as fast as our business increased.

THE BUDA ORGANIZATION, a 35-year outgrowth of the Quality First idea, cannot be increased on short notice without a departure from our fundamental policy—a thing which we never consider.

We are pleased to announce that we have at last, nevertheless, reached the point where we can make prompt deliveries, though we cannot promise that this condition will be permanent.

The BUDA COMPANY
HARVEY CHICAGO SUBURB ILLINOIS

MANUFACTURERS OF FINE MOTORS

THE BUDA COMPANY
BUDA MOTOR
"The part to buy the car by"
ESTABLISHED 1881

FOR CARS TRUCKS TRACTORS

Waltham

— the only automobile clock that tells the right time

because it is the only clock made specially for automobiles

BOILED-DOWN SERVICE

WHAT YOU SHOULD KNOW ABOUT ELECTRIC STARTING AND LIGHTING

ELECTRICAL FACTS

The author of this work spent weeks in the service stations of practically every important lighting and starting system manufacturer, for the sole purpose of getting facts on diagnosis and repair of electrical troubles. The book tells how to locate troubles and repair them.

Not a superfluous word is included. Exactly how to find and how to repair it—this is all you want to know and this is what is given.

This boiled-down service handbook will enable YOU to locate electrical troubles and repair them without having to wade through masses of irrelevant matter. It will save time, money and patience.

Size 5 x 8 inches—Fits your pocket.

Two bindings—
  Flexible leather.....75 cents
  Heavy cardboard....50 cents

Book Department

THE CLASS JOURNAL CO.

239 WEST 39th STREET, NEW YORK

Pride of Ancestry

Haynes
Built in 1897

"Ready to run anywhere," says the owner, Walter E. Smith, of Bound Brook, N. J.

Pride of Ancestry—based on performance, makes those fortunate enough to possess it careful to "Carry on the Good Name."

Look at this Old Haynes—still in the ring—after all these years.

The Haynes Automobile Company is mighty proud of the long-wearing qualities of this old car—and mighty careful to build long-wearing qualities into the present Haynes product (illustrated below).

So you naturally look for—and find—

Bound Brook Graphite and Bronze Oil-Less Bearings

among the other high quality units that enable the Haynes Car to stand up and deliver service year after year.

The builders of the Haynes Car know that a motor car lives only as long as its non-adjustable bearings; they know that many of these bearings are so located as to be difficult or impossible to keep properly lubricated; they know that non-lubricated bearings wear out *fast*—

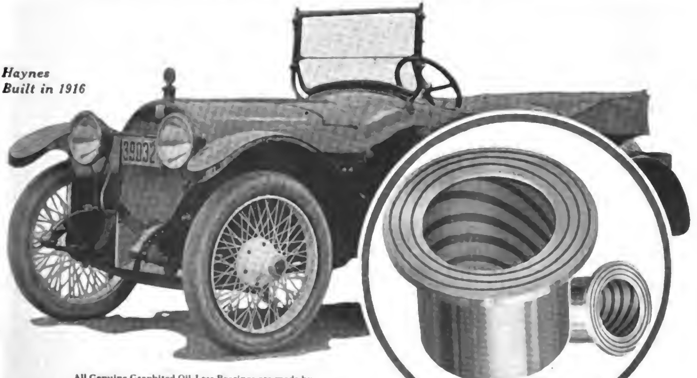
Consequently they use Bound Brook Oil-Less Bearings, that need no oiling. These bearings are "oiled for life" when they are made. Once installed they may be forgotten for they take care of themselves—need no attention of any kind—and while they work perfectly without oil, oiling will not hurt them.

They run with a smoothness and last for a length of time that no ordinary bearings could hope to equal.

Not only the Haynes, but nearly all American quality built cars are equipped in places with Bound Brook Oil-Less Bearings. Bound Brook Bearings in a car usually mean that only quality units are used throughout.

Bound Brook Oil-Less Bearings are made only to order, according to the specifications of the manufacturers using them.

Haynes
Built in 1916



All Genuine Graphited Oil-Less Bearings are made by

Bound Brook Oil-Less Bearing Company BOUND BROOK NEW JERSEY

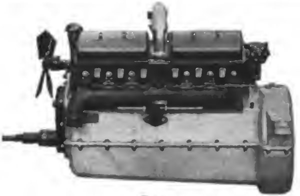
Specialists in the manufacture of Oil-Less Bearings for more than a quarter of a century

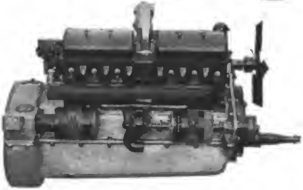
Also manufacturers of NIGRUM *"IMPREGNATED WOOD"* Oil-Less Bearings

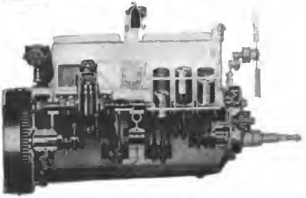
⑨

WEIDELY

12-Cylinder Motors







THE outstanding features of Weidely 12-cylinder V type motors are their surprising simplicity, their remarkable accessibility and their exceptional power due to their valves being located in head, to their light reciprocating parts and the large application of aluminum in their construction.

Other interesting constructional advantages are:

A Force Feed oiling system operated by gear driven pump supplies the three main bearings and through the drilled crankshaft supplies the connecting rod bearings.

A baffle plate in the crankcase just above the oil level prevents splash.

Connecting rods, crankshaft, camshaft, valve rocker arms, etc., all drop forged.

All moving parts enclosed.

All electrical equipment and water pump mounted on side of motor, leaving valve alley clear.

Spark plugs set in outer side of heads.

Carbureter suspended between cylinders from aluminum water jacketed intake pipe.

Water tunnel through crankcase from pump insures same temperature of water in each side of motor. Tunnel reinforced with steel tube.

Cylinders cast in triplets and staggered to allow side by side connecting rod construction.

Heads cast in sets of six, one on each side of motor attached to two sets of cylinders.

Valves in head operated by rocker arm and push rod construction.

Water circulation by pump driven from generator shaft.

Cooling fan belt driven from pump shaft has adjustment for taking up slack in belt.

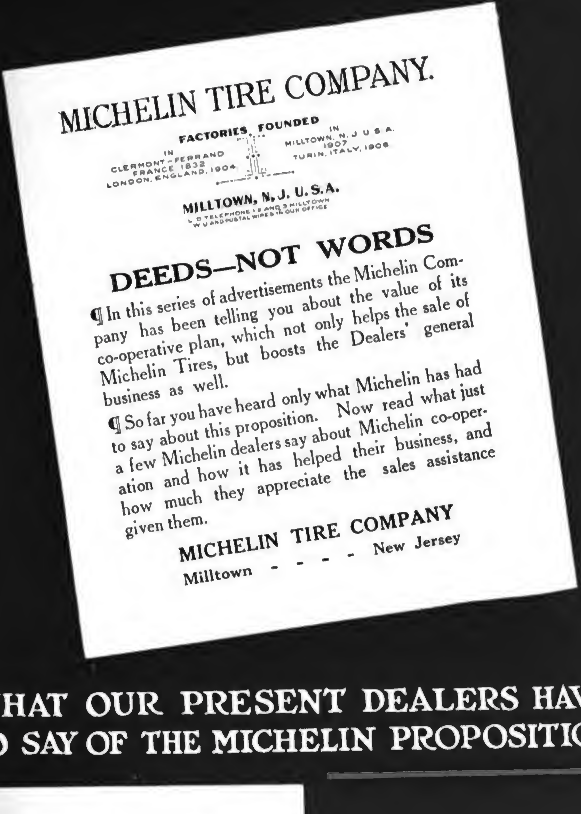
Oil filler standpipe at front of motor.

Specifications

Bore—2⅞".
Stroke—5".
Piston displacement—389 cu. in.
Overall length of motor—49½ in.
Overall width of motor—23 9/16 in.
Overall height of motor—33 5/16 in.
Valve diameter—1 9/32 in.
Crankshaft main bearings—2¼ in. diam.
Crankshaft conn. rod bearings—2" diam.
Length crankshaft main bearings, rear 4", center 2¼", front 2½", width crank pin bearing, 2⅞".
Camshaft bearings—1 11/16" diam.
Length camshaft bearings—rear 2 15/16", center 2 9/16", front 1⅞".
Crankshaft main bearings—babbitt.
Crankshaft conn. rod bearing—brass backed babbitt.
Width of timing gear face—1¼".
For further information—write, or call on us.

WEIDELY MOTORS COMPANY

Indianapolis Indiana



MICHELIN TIRE COMPANY.

FACTORIES, FOUNDED

IN
CLERMONT-FERRAND
FRANCE 1832
LONDON, ENGLAND, 1904

IN
MILLTOWN, N. J. U. S. A.
1907
TURIN, ITALY, 1906

MILLTOWN, N. J. U. S. A.
L. D. TELEPHONE 1 2 AND 3 MILLTOWN
W. U. AND POSTAL WIRES IN OUR OFFICE

DEEDS—NOT WORDS

¶ In this series of advertisements the Michelin Company has been telling you about the value of its co-operative plan, which not only helps the sale of Michelin Tires, but boosts the Dealers' general business as well.

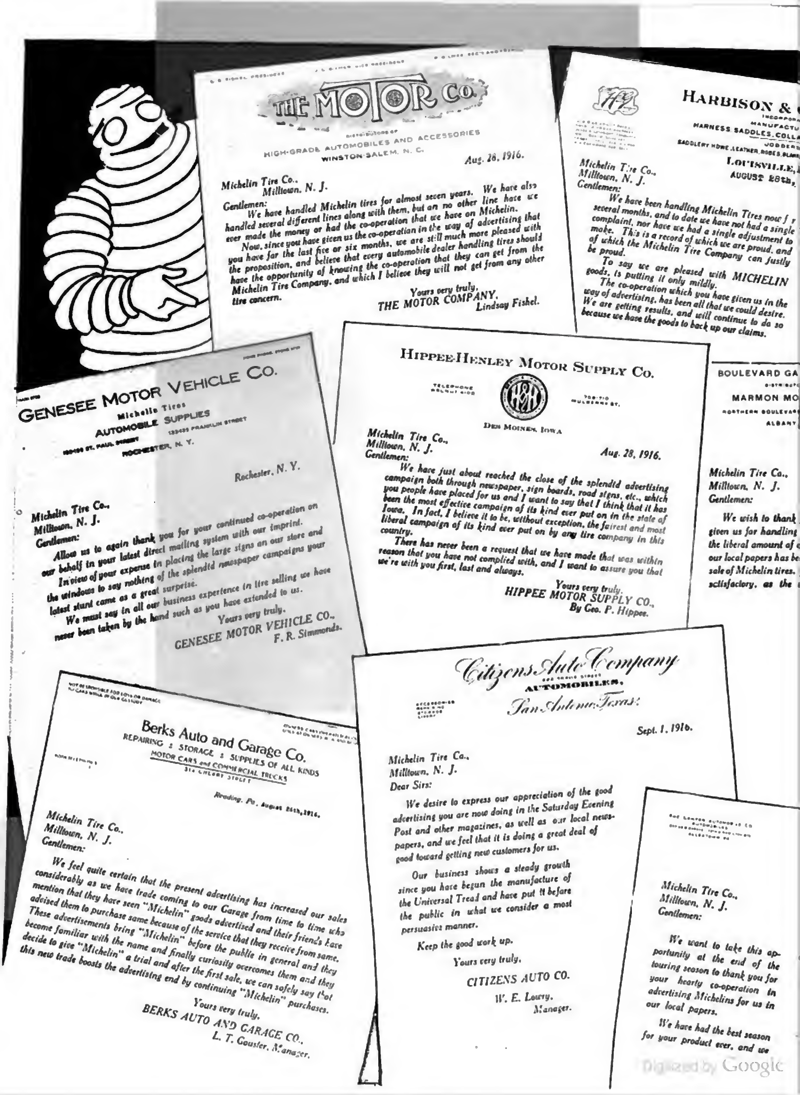
¶ So far you have heard only what Michelin has had to say about this proposition. Now read what just a few Michelin dealers say about Michelin co-operation and how it has helped their business, and how much they appreciate the sales assistance given them.

MICHELIN TIRE COMPANY
Milltown - - - - New Jersey

WHAT OUR PRESENT DEALERS HAVE TO SAY OF THE MICHELIN PROPOSITION

→

If the letters on the following pages interest *you*, write to Michelin and find out just what the Company has to offer in the way of sales co-operation.



THE MOTOR Co.
DISTRIBUTORS OF
HIGH-GRADE AUTOMOBILES AND ACCESSORIES
WINSTON-SALEM, N. C.

Aug. 28, 1916.

Michelin Tire Co.,
Milltown, N. J.

Gentlemen:

We have handled Michelin tires for almost seven years. We have also handled several different lines along with them, but on no other line have we ever made the money or had the co-operation that we have on Michelin.

Now, since you have given us the co-operation in the way of advertising that you have for the last five or six months, we are still much more pleased with the proposition, and believe that every automobile dealer handling tires should have the opportunity of knowing the co-operation that they can get from the Michelin Tire Company, and which I believe they will not get from any other tire concern.

Yours very truly,
THE MOTOR COMPANY,
Lindsay Fishel.

HARBISON &
INCORPORA
MANUFACTU
HARNESS SADDLES, COLLA
JOBBERS
SADDLERY HDWE., LEATHER, ROBES, BLANK
LOUISVILLE,

AUGUST 28th,

Michelin Tire Co.,
Milltown, N. J.

Gentlemen:

We have been handling Michelin Tires now f r several months, and to date we have not had a single complaint, nor have we had a single adjustment to make. This is a record of which we are proud, and of which the Michelin Tire Company can justly be proud.

To say we are pleased with MICHELIN goods, is putting it only mildly.

The co-operation which you have given us in the way of advertising, has been all that we could desire. We are getting results, and will continue to do so because we have the goods to back up our claims.

GENESEE MOTOR VEHICLE CO.
Michelin Tires
AUTOMOBILE SUPPLIES
ST. PAUL STREET
FRANKLIN STREET
ROCHESTER, N. Y.

Rochester, N. Y.

Michelin Tire Co.,
Milltown, N. J.

Gentlemen:

Allow us to again thank you for your continued co-operation on our behalf in your latest direct mailing system with our imprint.

In view of your expense in placing the large signs on our store and the windows to say nothing of the splendid newspaper campaigns your latest stunt came as a great surprise.

We must say in all our business experience in tire selling we have never been taken by the hand such as you have extended to us.

Yours very truly,
GENESEE MOTOR VEHICLE CO.,
F. R. Simmonds.

HIPPEE-HENLEY MOTOR SUPPLY CO.
DES MOINES, IOWA

Aug. 28, 1916.

Michelin Tire Co.,
Milltown, N. J.

Gentlemen:

We have just about reached the close of the splendid advertising campaign both through newspaper, sign boards, road signs, etc., which you people have placed for us and I want to say that I think that it has been the most effective campaign of its kind ever put on in the state of Iowa. In fact, I believe it to be, without exception, the fairest and most liberal campaign of its kind ever put on by any tire company in this country.

There has never been a request that we have made that was within reason that you have not complied with, and I want to assure you that we're with you first, last and always.

Yours very truly,
HIPPEE MOTOR SUPPLY CO.,
By Geo. P. Hippee.

BOULEVARD GA
MARMON MO
NORTHERN BOULEVAR
ALBANY

Michelin Tire Co.,
Milltown, N. J.

Gentlemen:

We wish to thank
given us for handling
the liberal amount of
our local papers has be
sale of Michelin tires.
satisfactory, as the

Berks Auto and Garage Co.
REPAIRING : STORAGE : SUPPLIES OF ALL KINDS
MOTOR CARS and COMMERCIAL TRUCKS

Reading, Pa., August 26th, 1916.

Michelin Tire Co.,
Milltown, N. J.

Gentlemen:

We feel quite certain that the present advertising has increased our sales considerably as we have trade coming to our Garage from time to time who mention that they have seen "Michelin" goods advertised and their friends have advised them to purchase same because of the service that they receive from same. These advertisements bring "Michelin" before the public in general and they become familiar with the name and finally curiosity overcomes them and they decide to give "Michelin" a trial and after the first sale, we can safely say that this new trade boosts the advertising end by continuing "Michelin" purchases.

Yours very truly,
BERKS AUTO AND GARAGE CO.,
L. T. Gouster, Manager.

Citizens Auto Company
AUTOMOBILES.
San Antonio, Texas.

Sept. 1, 1916.

Michelin Tire Co.,
Milltown, N. J.

Dear Sirs:

We desire to express our appreciation of the good advertising you are now doing in the Saturday Evening Post and other magazines, as well as our local newspapers, and we feel that it is doing a great deal of good toward getting new customers for us.

Our business shows a steady growth since you have begun the manufacture of the Universal Tread and have put it before the public in what we consider a most persuasive manner.

Keep the good work up.

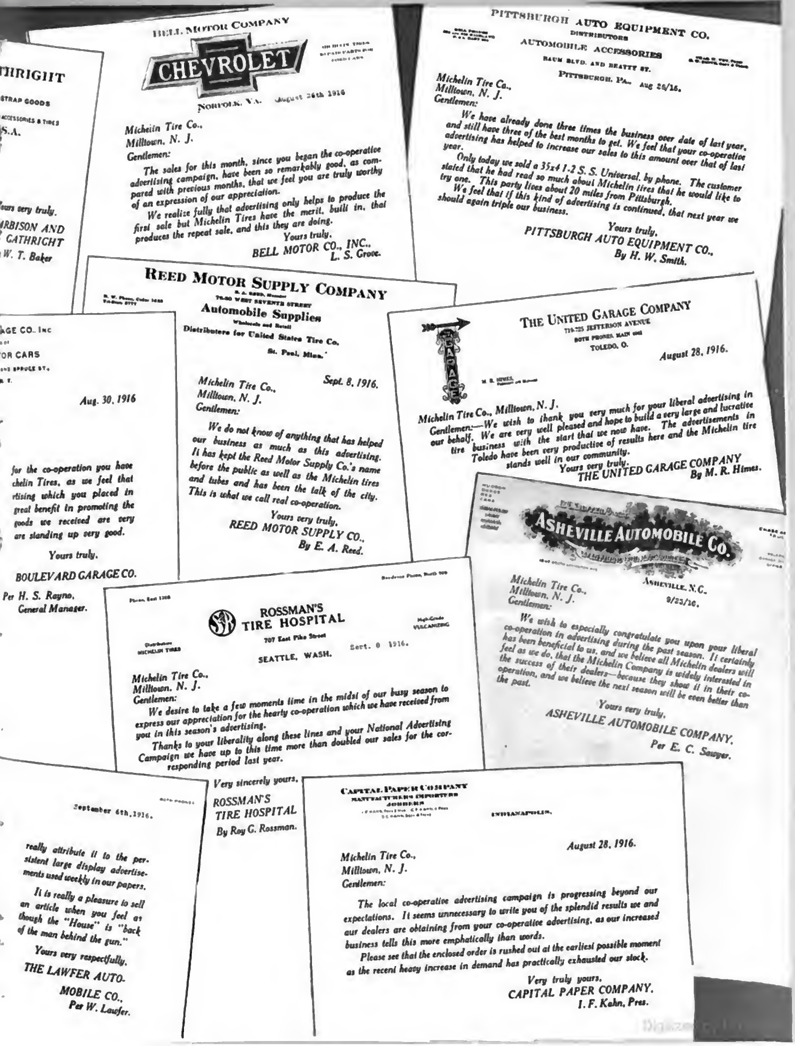
Yours very truly,
CITIZENS AUTO CO.
W. E. Lowry,
Manager.

Michelin Tire Co.,
Milltown, N. J.

Gentlemen:

We want to take this opportunity at the end of the touring season to thank you for your hearty co-operation in advertising Michelins for us in our local papers.

We have had the best season for your product ever, and we



THRIGHT

STRAP GOODS

ACCESSORIES & TIRES

S.A.

Yours very truly.

RBISON AND

GATHRIGHT

W. T. Baker

BELL MOTOR COMPANY

CHEVROLET

NORFOLK, VA. August 26th 1916

Michelin Tire Co.,
Milltown, N. J.
Gentlemen:

The sales for this month, since you began the co-operative advertising campaign, have been so remarkably good, as compared with previous months, that we feel you are truly worthy of an expression of our appreciation.

We realize fully that advertising only helps to produce the first sale but Michelin Tires have the merit, built in, that produces the repeat sale, and this they are doing.

Yours truly.
BELL MOTOR CO., INC.,
L. S. Grove.

PITTSBURGH AUTO EQUIPMENT CO.
DISTRIBUTORS
AUTOMOBILE ACCESSORIES
BAUM BLVD. AND BEATTY ST.
PITTSBURGH, PA., Aug 26/16.

Michelin Tire Co.,
Milltown, N. J.
Gentlemen:

We have already done three times the business over date of last year, and still have three of the best months to get. We feel that your co-operative advertising has helped to increase our sales to this amount over that of last year.

Only today we sold a 35x4 1-2 S. S. Universal, by phone. The customer stated that he had read so much about Michelin tires that he would like to try one. This party lives about 20 miles from Pittsburgh.

We feel that if this kind of advertising is continued, that next year we should again triple our business.

Yours truly,
PITTSBURGH AUTO EQUIPMENT CO.,
By H. W. Smith.

REED MOTOR SUPPLY COMPANY
70-80 WEST SEVENTH STREET
Automobile Supplies
Wholesale and Retail
Distributors for United States Tire Co.
St. Paul, Minn.

Michelin Tire Co.,
Milltown, N. J.
Gentlemen:

Sept. 8, 1916.

We do not know of anything that has helped our business as much as this advertising. It has kept the Reed Motor Supply Co.'s name before the public as well as the Michelin tires and tubes and has been the talk of the city. This is what we call real co-operation.

Yours very truly,
REED MOTOR SUPPLY CO.,
By E. A. Reed.

AGE CO., INC

OR CARS

AND SPRUCE ST.,

Aug. 30, 1916

for the co-operation you have
chelin Tires, as we feel that
rtising which you placed in
great benefit in promoting the
goods we received are very
are standing up very good.

Yours truly.

BOULEVARD GARAGE CO.

Per H. S. Rayno,
General Manager.

THE UNITED GARAGE COMPANY
JEFFERSON AVENUE
BOTH PHONES MAIN
TOLEDO, O.

GARAGE

M. R. HIMES,

August 28, 1916.

Michelin Tire Co., Milltown, N. J.

Gentlemen:—We wish to thank you very much for your liberal advertising in our behalf. We are very well pleased and hope to build a very large and lucrative tire business with the start that we now have. The advertisements in Toledo have been very productive of results here and the Michelin tire stands well in our community.

Yours very truly,
THE UNITED GARAGE COMPANY
By M. R. Himes.

ASHEVILLE AUTOMOBILE Co.

ASHEVILLE, N.C.
9/23/16.

Michelin Tire Co.,
Milltown, N. J.
Gentlemen:

We wish to especially congratulate you upon your liberal co-operation in advertising during the past season. It certainly has been beneficial to us, and we believe all Michelin dealers will feel as we do, that the Michelin Company is widely interested in the success of their dealers—because they show it in their co-operation, and we believe the next season will be even better than the past.

Yours very truly,
ASHEVILLE AUTOMOBILE COMPANY.
Per E. C. Sawyer.

ROSSMAN'S
TIRE HOSPITAL
707 East Pike Street
SEATTLE, WASH.

Distributors
MICHELIN TIRES

High-Grade
VULCANIZING

Sept. 8 1916.

Michelin Tire Co.,
Milltown, N. J.
Gentlemen:

We desire to take a few moments time in the midst of our busy season to express our appreciation for the hearty co-operation which we have received from you in this season's advertising.

Thanks to your liberality along these lines and your National Advertising Campaign we have up to this time more than doubled our sales for the corresponding period last year.

Very sincerely yours,
ROSSMAN'S
TIRE HOSPITAL
By Roy G. Rossman.

September 6th,1916.

really attribute it to the persistent large display advertisements used weekly in our papers.

It is really a pleasure to sell an article when you feel as though the "House" is "back of the man behind the gun."

Yours very respectfully,
THE LAWFER AUTOMOBILE CO.,
Per W. Lawfer.

CAPITAL PAPER COMPANY
MANUFACTURERS IMPORTERS
JOBBERS

INDIANAPOLIS.

August 28, 1916.

Michelin Tire Co.,
Milltown, N. J.
Gentlemen:

The local co-operative advertising campaign is progressing beyond our expectations. It seems unnecessary to write you of the splendid results we and our dealers are obtaining from your co-operative advertising, as our increased business tells this more emphatically than words.

Please see that the enclosed order is rushed out at the earliest possible moment as the recent heavy increase in demand has practically exhausted our stock.

Very truly yours,
CAPITAL PAPER COMPANY.
I. F. Kahn, Pres.

IT should be borne in mind that the new Michelin Universal Tread is the product of four years careful experiment both in laboratory and on the road.

In addition to its great durability and resiliency the new Michelin Universal Tread affords unusual protection against skidding due to the unique design of the extra heavy added non-skid tread. This tread is a combination of the really valuable features of suction type non-skids and the raised or studded types, and it unites in the one casing advantages never before thought possible.

Like the Michelin flat tread the secret of the remarkable durability of this new casing is in the extra heavy broad flat added tread, a tread that sticks to the ground when the car is started, without wearing away as result of slipping.

Again let us emphasize the point that while the tire is the highest possible quality that can be built, the prices are no higher than ordinary tires.

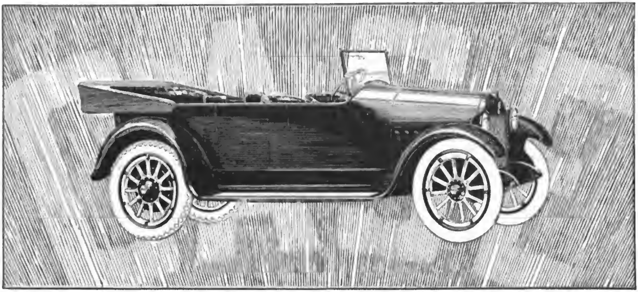
MICHELIN

MICHELIN red rubber inner tubes really enjoy their world-wide reputation because of two basic features of their construction.

First: Michelin Inner Tubes are compounded from certain quality-giving ingredients which prevent them from becoming brittle or porous and which preserve their velvety softness indefinitely.

Second: Michelin Tubes are not simply pieces of straight tubing with their ends cemented together, but they are formed on a ring mandrel to exactly the circular shape of the inside of the casing into which they fit perfectly.

MICHELIN TIRE COMPANY
Milltown - - - - New Jersey



Why the Case "Forty" Sells So Easily

Reasons That Dealers Give

Power—abundant power to send this long, strong car, loaded to full capacity, through miles of mud and straight up hills where scores of other cars falter.

Beauty—striking beauty expressed in the high, imposing hood, in the long, sweeping lines of the body and in molded curves and rich finish.

Comfort—riding comfort and luxury due to the 120-inch wheelbase, Case cantilever spring suspension, roomy body, separate front seats, and real grain leather upholstery. All these in a car at $1190, remember. And—

Public Acceptance—the unshaken confidence which men have in all Case products *and have had for three-quarters of a century.*

This *Public Acceptance* of Case dependability means that half your battle is won when you *start* to make a sale.

Compare this, please, with the argument, time and persuasion necessary to sell other cars that do not possess Case quality.

Write for Surprising Proposition

At present we are expanding our organization of dealers in a few localities where Case has no local representation. Our plan is the most attractive, we believe, that any reliable maker has to offer.

To investigate this before we withdraw it, will well repay any good aggressive dealer. Write us today.

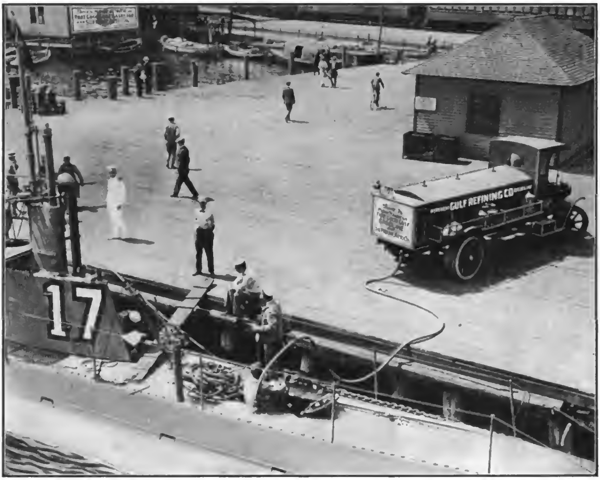
J. I. CASE T. M. CO., Inc., 113 Liberty St., Racine, Wis.
FOUNDED 1842

CASE

The Sign of Mechanical Excellence the World Over

(477)

Supplying the Sinews



Copyright 1916 by the Pach Photo News.

GASOLINE for a submarine must be of the highest quality. The dangerous undertaking of the undersea boat demands the best.

There is a very suggestive story in this illustration showing THAT GOOD GULF GASOLINE being delivered to the United States Submarine "D-1" at New London, Conn., preparative to its participation in the maneuvers of the Atlantic Squadron off the Massachusetts coast, Sept. 5th, 1916.

Gasoline good enough for submarine service is certainly good enough for you—and far better than others you can buy at the same price.

Put THAT GOOD GULF GASOLINE in your tank, and feel the exhilaration of **More Power** in your motor.

GULF REFINING COMPANY

The Largest Independent Refining Company in the World

General Sales Offices: Pittsburgh, Pa., U. S. A.

DISTRICT SALES OFFICES:
New York, Philadelphia, Boston, Atlanta, Tampa New Orleans, Houston

TAKE OUT THAT KNOCK

THAT knocking in your engine, the difficulty you have negotiating hills—the poor acceleration response—lack of power—extravagant use of oil and gas — noisy motors — in fact fully 80% of your engine trouble is caused by just one thing—carbon in your cylinders. Clean them out with

JOHNSON'S CARBON REMOVER

and your engine will run like it did the first 500 miles—quietly and full of "pep". ***No matter how choked up*** your motor may be Johnson's Carbon Remover penetrates and softens the carbon—then the heat from the engine burns and pulverizes it so that it blows out of the exhaust as you operate your car.

YOU CAN DO IT YOURSELF

Why pay from $3.00 to $5.00 for having the carbon burned out of your cylinders when you can easily do it yourself ***without laying up your machine,*** without even soiling your hands. You can apply it to the motor warm or cold and let it remain in an hour or over night, whichever is the most convenient.

SAVES GASOLINE

Clean cylinders reduce the consumption of gas from 12% to 20% giving you the maximum power and speed from the minimum amount of fuel. Johnson's Carbon Remover **saves you money** because the economy in fuel effected by its use more than makes up the price of the Carbon Remover.

SAVE YOUR BATTERIES

There is nothing that runs down your batteries like the self-starter. Free-from-carbon cylinders greatly facilitate starting. The use of Johnson's Carbon Remover every 1000 miles will keep your engine clean and sweet and always at its highest efficiency. It does not in any way injure the oil in the crank case.

OUR GUARANTEE

You take no chances for we guarantee Johnson's Carbon Remover without equivocation. ***No matter how much you use or how you use it, Johnson's Carbon Remover cannot injure any part of your motor.*** It is absolutely harmless to everything except carbon. You could soak your engine in it for days without the slightest injury. We guarantee it to be free from acids and chemicals.

Knock!
Knock!
Knock!
Knock!

Introductory Offer

We will send you by prepaid express for $1.00 (bill or stamps) enough of Johnson's Guaranteed Carbon Remover to thoroughly clean any ordinary four cylinder motor three times. — Please give us the name of your dealer.

J. C. JOHNSON & SON
Dept. A., Racine, Wis.

Warner Mfg. Co. Adopts Oil-Hardened Vanadium Steel Gears

After exhaustive tests of different types of alloy steel oil-hardening stock, considering their relative merits both from production and service standpoints, the Warner Mfg. Co. has adopted oil-hardened vanadium steel gears as standard for transmissions.

Case-hardened gears had been standard, but the results of the tests were so conclusive of the superior merits of oil-hardened vanadium steel that the company did not hesitate to make the change in the midst of production.

Entire freedom from ugly, sticky scale;

Uniformity of composition and freedom from segregation;

Easy machining qualities, necessitating no change in shop practice—

Were the characteristic and distinctive features which led to the choice of vanadium steel.

It was found that 25% to 30% higher rate of production could be maintained with vanadium steel than with the other alloy steels considered.

AMERICAN VANADIUM COMPANY

New York Pittsburgh London

A Power Plant Standardized One Hundred Years Ago

It is in its power plant only that the Stanley is different. So far as general equipment is concerned, Stanley equipment is such as is used on the best types of internal explosive cars: Timken bearings and Timken front axle; Wyman & Gordon drop forgings; Warner steering gear; Mayo radiator; Silvertown cord tires; Warner speedometer; Klaxon horn; Apple dynamo and Willard battery for lights and horn; Aluminum body.

It is in its power plant that the Stanley is different—and it is in this difference that the Stanley is fundamentally superior. Because of this steam power plant the Stanley is called unconventional, and as compared with the internal explosive automobile it is unconventional—but in that sense only. As a matter of fact its power plant is the most conventional, the oldest, the most highly standardized, the most efficient, the simplest, the safest and the least mysterious that science has ever devised for driving a road vehicle.

Do You Know How Many Cylinders Are Necessary

properly to propel an automobile? One of the most successful manufacturers, having tried one and four and six, now says twelve is the proper and necessary number. The most successful manufacturer in the world says that four cylinders are enough. Who knows? Does any automobile engineer know? Does any automobile user know? Do you?

This problem arises from the fact that the internal explosive engine is essentially and normally a constant speed, constant load motor, and as such is fundamentally unsuited for a variable speed, variable load device like an automobile.

The number of cylinders necessary to drive a road vehicle was absolutely and definitely fixed nearly 100 years ago.

George Stephenson Laid Down The Principle

in 1820. And the principle he definitely fixed is that of a two cylinder engine, double acting (taking steam in each direction) simple (using the steam in one expansion only), with slide valves and link motion reverse.

Since Stephenson's time poppet valve engines have been tried, compound engines, multiple cylinder engines, rotary engines have been tried. All have been found wanting. In other words, Stephenson's principle has become definitely fixed, not because nothing else has been tried, but because EVERYTHING else has been tried.

To accomplish the result which you long for—which every automobile engineer is struggling honestly to give you—to deliver a smooth, continuous torque to the crankshaft without "impulses"—without even "overlapping impulses"—in other words, properly to propel an automobile—only two cylinders, and only thirteen moving parts are needed in the complete engine. As applied in Stanley construction, this fundamentally correct engine is geared direct and permanently to the rear axle, without "transmission" or gear-shift—the engine speed is the car speed. The steam which supplies this engine is stored in the generating plant under the hood, which is nothing more than a kerosene stove boiling water, with no moving parts, no carburetor, no ignition system. The volume of steam entering the engine controls the speed of the car, and this is governed by the little finger throttle—the sole controlling device on the whole car. Thus the power from the liquid fuel is transmitted to the rear wheels with no carburetor, no ignition system, no clutch, no flywheel, no gear-shift, no "transmission," and with only thirteen moving parts.

What You Want Is Stanley Performance

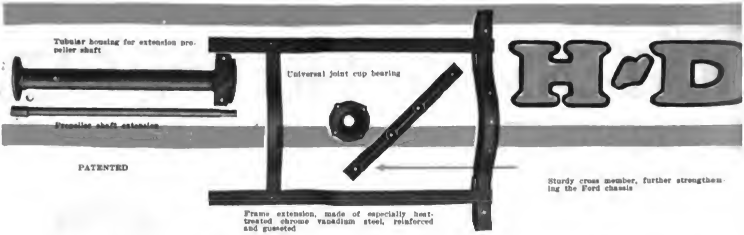
You have been willing to try six, eight, and even twelve cylinders in searching for your ideal performance—for a smooth, continuous torque; a steady, uninterrupted flow of driving power; with power stored for the critical emergencies; without clutch or gear-shift; with all controlling devices limited to a single finger lever. We offer you this ideal performance.

Don't let the notion that the Stanley is "unconventional" deter you longer from riding it—from driving it yourself—from experiencing for yourself the relief from physical hardship and mental anxiety which this most highly standardized car in the world can alone give you. We shall be glad to hear from you and to send you our booklet.

The Stanley Touring Car is $1975 f. o. b. Newton, Mass. Wire Wheels $90 extra. Wheelbase, 130 inches—Tires 34x4½ Silvertown—Aluminum Body—12 Miles to the Gallon of Kerosene—200 Miles to a Tank of Water.

Founded 1898

STANLEY MOTOR CARRIAGE CO., NEWTON, MASS.


Tubular housing for extension propeller shaft
Universal joint cup bearing
H-D
Propeller shaft extension
PATENTED
Sturdy cross member, further strengthening the Ford chassis
Frame extension, made of especially heat-treated chrome vanadium steel, reinforced and gusseted

HERE'S the most attractive profit-making proposition that has ever been offered the trade—converting a Ford chassis into the most efficient 1000 lb. truck on the market by lengthening its wheelbase 30 inches. This gives a wheelbase 130 inches long, which permits the use of a body with from 90 to 104 inches loading space *behind the driver's seat*, thus meeting the need of half a million merchants for bigger bodies that will allow the carrying of a profit-making load.

Every tradesman who makes a delivery is a prospect for this extension—every city, town, village or cross-roads contains logical buyers for the H-D Extension. Engineers admit that the

Ford Chassis Is the Sturdiest and Most Efficient Carrier of 1000 Lbs.

The difficulty has been the skimpy box-body that had to be fitted, due to the short wheelbase. Where greater loading space was demanded, an unreasonable overhang ruined tires, broke down the rear construction and unreasonably handicapped a chassis that is logically the best 1000 lb. carrier in existence.

Statistics show that 80 per cent of all commercial delivery is made with loads of 1000 lbs. and less—no matter whether the truck that carries the load is 2-ton or bigger.

Body room—adequate loading space—has been the great demand, and this demand is completely satisfied by the use of the H-D Extension for Fords.

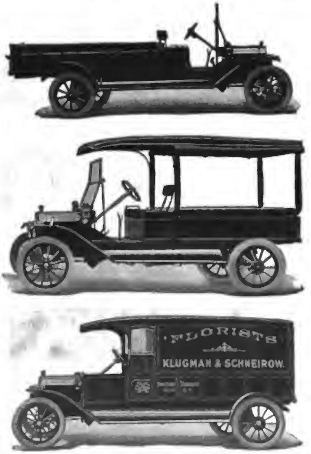
The cost—$60 complete F.O.B. New York—is so low that 10 merchants will buy this extension for every one that will consider buying a new truck or give serious thought to the high-priced propositions, which require an expenditure all out of proportion to the original Ford investment.

See the Magnificent Profit Possibilities

that the H-D opens up for you. There's profit on the sale of the extension—you equip it yourself without drilling a hole or leaving off any part of the Ford chassis. The customer is then a prospect for a body, and there's another and perfectly legitimate profit for you. A new Ford chassis, an H-D Extension and a panel delivery body,, combining to make an unequaled 1000 lb. truck, you can thus sell complete for about $605, several hundred dollars below any other good 1000 lb. job, and you have the advantage of an increased loading space that no other 1000 lb. truck can equal.

Every extension you sell—every Ford wheelbase you lengthen to 130 inches—every complete job that rolls around your town, is a persuasive salesman that leads other merchants to your store. Equip a demonstrator yourself—convert a used Ford chassis into the H-D Extension—put on a long body—show it in your store, or in front of your place of business, on the floor of your garage—and it will immediately prove that the H-D Extension will be more profitable than a car agency.

You need not be a marvelous merchandiser—you need not be a wizard of finance—you do not need a small fortune to start in this business. A few dollars, a few extensions, one job equipped, and the business can be carried on to a surprising financial success by the use of simple common sense and a little get-up-and-hustle.

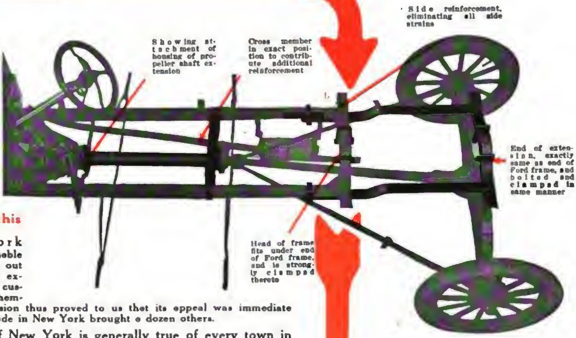


The illustrations above show three varieties of delivery jobs whose efficiency has been increased 100% by using the H-D Extension.

HAYES-DIEFENDERFER COMPANY,

EXTENSION FOR FORD CARS

Showing in detail how the H-D Extension lengthens the wheelbase.


Side reinforcement, eliminating all side strains
Showing attachment of housing of propeller shaft extension
Cross member in exact position to contribute additional reinforcement
End of extension, exactly same as end of Ford frame, and bolted and clamped in same manner
Head of frame fits under end of Ford frame, and is strongly clamped thereto

We've proved all this in our New York branch. We were unable to turn complete jobs out fast enough—we sold extensions and let the customers put them on themselves—and the extension thus proved to us that its appeal was immediate and that every sale made in New York brought a dozen others.

What is true of New York is generally true of every town in the United States where the H-D was introduced.

We're ready now. Our factories are stocked ahead with the extensions, and we can take care of deliveries immediately.

$60

We take care of you on bodies, too. Several big factories are engaged in turning out long bodies for us, and we can take care of our dealers on these bodies in a way to enable them to meet and beat any local body competition, and at the same time reserve a good margin of profit for themselves.

DEALERS

Take note of the Ford delivery jobs in and around your town with little box-like bodies, with rear-breaking overhangs, and mark well that every one is a prospect for you.

Then get busy and find what the H-D agency will do for you. Don't wait—just figure out the profit possibilities and wire.

237 West 55th Street, New York City

…stone
…n for Dealers
Page 3
Our Business is to Boom You.

Good Trade Comes Out Of This Book

"Times" can always be better—no matter how good they are now—and this book points a way—a way to mutual help between you and the Firestone Company; this is the World's Largest Organization in its exclusive line, and they realize that every Firestone dealer is a valued factor in it. Therefore, the Firestone co-operation and Selling Helps have been planned by experts to boost hard for the common good. This book explains details.

Firestone Quality Makes Sales

You offer the tire that everybody knows stands for the highest limit of value, the extreme length of service, the all around good tire that needs no explaining, that has sold itself to the public by its continuous record of maximum service through every test for sixteen years. Write today for the Book.

Firestone Tire and Rubber Co., Akron, Ohio—Branches and Dealers Everywhere

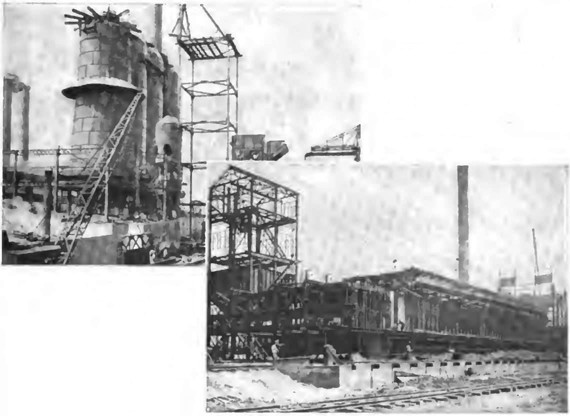
"America's Largest Exclusive Tire and Rim Makers"

FREE—FIRESTONE CEMENTLESS TUBE PATCH. To prove the superlative working success of Firestone patches, we will send one FREE to the address of any car owner or dealer

Firestone

The Foundation of United Service

An Efficient Organization
and Modern Equipment



THESE illustrations show the coke-ovens and blast furnace now almost completed in our new unit, Plant "B."

When this new unit is in operation, we will completely control the manufacture of our product.

Every operation in the manufacture of our steel, from the ore to the finished bar, will take place in our own plant under our own organization, trained in the manufacture of Alloy Steels. This will insure our customers of uniformly high quality and prompt service.

Chrome Vanadium *Chrome Nickel* *Chrome* *Silico Manganese*
Special Analysis *Nickel* *Magnet* *Chrome Silico Manganese*

THE UNITED ALLOY STEEL CORPORATION

Successors to
The United Steel Company

Basic Open Hearth *Heroult Electric*

CANTON, OHIO

Announcing

OLD SOL

NITROJECTOR No 100

THE 100% PERFECT SPOTLIGHT

More than a spotlight? Yes!

Years ahead in improvements? Yes! It anticipates the law.

The NITROJECTOR No. 100 is the only light offering absolute surety that the driver is within the law. And it is fully covered with Patent Protection.

In fact, the OLD SOL NITROJECTOR has revolutionized present ideas of "lighting the way" and provides so many new and necessary features for the motorist that every car owner in the country will take advantage of this wonderful light.

The OLD SOL NITROJECTOR has at least ten exclusive features that cannot be found in combination in any other motor car lighting device in the market.

OLD SOL SPOTLIGHTS

No. 70. Always a big seller. Many special features over all other spotlights. **Price $7.00.**

No. 77. Just right for the smaller car with the exclusive features of No. 70. **Price $5.00.**

No. 1 It is the only light in the world with a cylindrical double shutter. This exclusive OLD SOL device, in combination with the Universal Bracket, gives instant and perfect control of the light at any height or distance.

No. 2 There are three silvered reflector surfaces. The light does not spring out in a glare from a parabola reflector but is caught on a spherical door reflector thrown back again on a spherical body reflector and then is brilliantly spotted or diffused by means of the OLD SOL focusing device, and a rim parallel beam reflector.

No. 3 The OLD SOL NITROJECTOR has an original and exclusive focus device which can be instantly adjusted for a spot or diffused light at any height upon the road to meet the law.

No. 4 Each NITROJECTOR No. 100 is equipped with a large four inch diminishing mirror. This safety device is absolutely rigid yet adjustable by a touch of the finger. An exclusive equipment and patented.

No. 5 The OLD SOL NITROJECTOR universal bracket is the only bracket on any light that will fit the tapered windshield. This bracket is a standard specification for every car except the Studebaker for which a special bracket will be supplied, when specified, at no extra cost.

No. 6 With each OLD SOL NITROJECTOR five feet of Electric Duplex Braided Cable is supplied. Only the best quality of insulation is used on this cable. Each section is provided with copper terminals at the four ends furnishing a quick means of installation.

No. 7 OLD SOL NITROJECTOR is the only spotlight on the market that has twin (central and pilot) bulbs. The pilot light bulb provides for a secondary illumination of less candle power than the main bulb, and confines the light to a generally downward direction as required in many city ordinances and state laws.

No. 8 OLD SOL NITROJECTOR switch is an integral part of the focusing device and the operating handle. All parts of focus device are scientifically insulated. Patented cork protector against moisture and dust in switch.

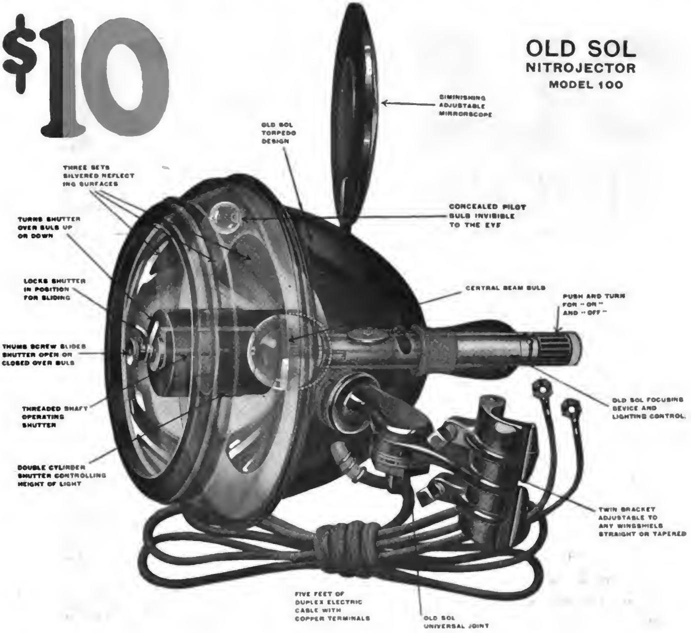
No. 9 Other exclusive OLD SOL features are the "on" and "off" control on the end of the handle — as simple and convenient as an electric light switch and the focusing device and switch that "spots" or "diffuses" the light far into the distance ahead.

No. 10 The exclusive torpedo design—a shape that beautifies the superiorities of OLD SOL NITROJECTOR making this the most handsome and efficient light given to the public.

Ten Exclusive Features

$10

OLD SOL
NITROJECTOR
MODEL 100


DIMINISHING ADJUSTABLE MIRRORSCOPE
OLD SOL TORPEDO DESIGN
THREE SETS SILVERED REFLECTING SURFACES
CONCEALED PILOT BULB INVISIBLE TO THE EYE
TURNS SHUTTER OVER BULB UP OR DOWN
LOCKS SHUTTER IN POSITION FOR SLIDING
CENTRAL BEAM BULB
PUSH AND TURN FOR "ON" AND "OFF"
THUMB SCREW SLIDES SHUTTER OPEN OR CLOSED OVER BULB
OLD SOL FOCUSING DEVICE AND LIGHTING CONTROL.
THREADED SHAFT OPERATING SHUTTER
DOUBLE CYLINDER SHUTTER CONTROLLING HEIGHT OF LIGHT
TWIN BRACKET ADJUSTABLE TO ANY WINDSHIELD STRAIGHT OR TAPERED
FIVE FEET OF DUPLEX ELECTRIC CABLE WITH COPPER TERMINALS
OLD SOL UNIVERSAL JOINT

DEALERS—OLD SOL NITROJECTOR will revolutionize your business in spotlights. It is years ahead of any light upon the market. Its advantages will be the talk of motorists throughout the country. The fastest selling accessory ever marketed. Get in touch with your jobber at once and arrange for your first shipment. Every car owner in your community will buy one once he knows about it.

JOBBERS—If you are not already in a position to take care of your trade "get there" immediately. Write or wire us at once. Deliveries of Model 100 NITROJECTOR commence January first. Send for contract.

Canadian Price, Model 100, $15.00

HAWTHORNE MANUFACTURING CO., INC.
BRIDGEPORT, CONNECTICUT, U. S. A.

Makers of Old Sol Windshield Spotlights and electric lighting devices.

Knowledge Beats Guess-Work

Some winter hints on battery care

Whether you drive all winter or not—don't guess about your battery's condition. This applies no matter where you live.

A Willard Battery fully charged and filled with pure distilled water will not freeze. If *discharged* it may freeze at 20° above zero.

Every car owner should own a hydrometer syringe for testing his battery's charge. This is equally important in summer or winter.

Any storage battery will wear out in time, but good care prolongs life.

Willard Service is Expert

To be good, service must be more than ability to make repairs. Over 750 Willard Service Stations stand ready to give willing help and valuable advice. Let the Willard man nearest you inspect your battery free and tell you what it needs during the winter. Ask for list of stations.

If You Store Your Car in Winter

Relieve yourself of worry by letting the Willard Service Station nearest you take care of it during the winter. If you follow the Willard man's advice, it means, when spring comes, a battery full of pep and ready for the road.

A Willard hydrometer will be mailed postpaid for one dollar with full instructions and free booklet on winter care of your battery. If you wish booklet without hydrometer, ask for No. M-13.

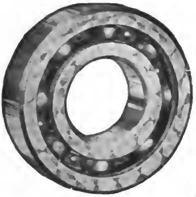
Willard Storage Battery Company
Cleveland, Ohio

NEW YORK: 228-230 West 58th Street
DETROIT: 736-38-40 Woodward Ave.
CHICAGO: 2524-34 So. Wabash Avenue
SAN FRANCISCO: 1433 Bush Street
ATLANTA: 8-10 East Cain Street
MINNEAPOLIS: 36-38-40 So. 10th St.
INDIANAPOLIS: 316-318 North Illinois Street

SOUTHWESTERN DISTRIBUTORS:
Willard Storage Battery Company of Texas, Dallas, Tex.

Direct Factory Representatives in Philadelphia, Boston, Kansas City, Omaha, Seattle. Service Stations in all principal cities in the United States and Canada.

Willard Storage Batteries are for sale by car dealers, garages, and all Willard Service Stations and Factory Branches.



U. S.

BALL BEARINGS

U. S. Ball Bearings are made in the factory illustrated opposite—which has a capacity of 10,000 quality ball bearings per day.

When Operating Conditions Are Severest

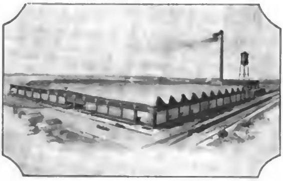
Not only have ball bearings shown marked superiority in racing work, but in commercial vehicle work, where loads are greatest and strains heaviest, there, too, have ball bearings stood out prominently as the superior form of anti-friction device.

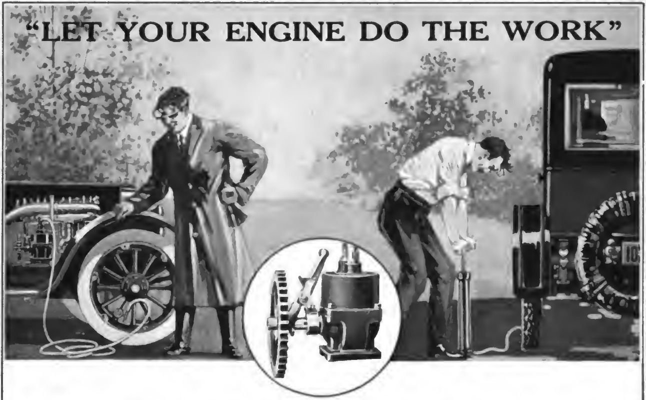
To obtain the most highly efficient type of worm gear axle, it is necessary to have an axle in which the worm loads, both thrust and radial, are carried on ball bearings.

In England where the worm gear was first developed and where there, as in America, it is the dominant type, the producers of the finest worm gear units warn against the use of annular bearings in handling these worm loads; and in this country, the leading exponents of worm-driven rear axles have made the carrying of both the thrust and radial load of the worm on ball bearings, one of the basic principles of their axle construction.

Surely if ball bearings are better on racing cars, as is admitted by American manufacturers who use them, better on the dominant type of truck, then surely they should be better for pleasure car work. As a matter of fact, they are.

U. S. Ball Bearing Manufacturing Co.
(Conrad Patent Licensee)
Palmer Street and Kolmar Avenue, Chicago




"LET YOUR ENGINE DO THE WORK"
10

$10 Which of these Men are You? $10

CASSCO
ENGINE DRIVEN
TIRE PUMP

Installation

Special brackets and fittings have been designed which permit an easy installation by car owner. No machine work or chipping necessary.

Capacity

The Cassco Pump will inflate a 34 x 4 tire to 80 pounds pressure in two minutes; other sizes in proportionate time.

Are you the man who blisters his hands, strains his back and tries his patience by pumping tires with the old hand pump? The game isn't worth the candle. You can rid yourself of this "kill-joy" of motoring with the Cassco Engine Driven Tire Pump.

The Cassco is simple in operation and dependable in performance. It is constructed by practical men of wide experience. Every part is made of the material that experience has proved is best suited for the function that each part has to perform.

A post card addressed to the Sales Managers will bring an interesting leaflet, detailing the simplicity and construction of the Cassco. Write for it.

Manufacturers: WEST SIDE FOUNDRY CO., Troy, New York

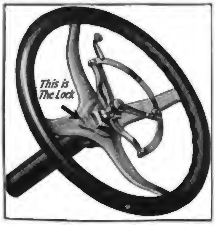
Sales Managers

EDWARD A. CASSIDY COMPANY, INC., 30 East 42d St., New York City

Tomorrow YOUR car may be stolen

"Perry" Lock laughs at Auto Thieves

Attached to any make of car in 15 minutes. Does not interfere with nor change any of the standard parts of Steering Gear. Absolutely safe to drive.



When locked "It spins like a top"

It locks the whole car

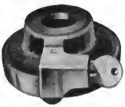
Don't confuse the "Perry" with any "Auto Lock" you have ever known. A "Perry" Locked Car cannot be towed or driven away—when locked the Steering Wheel has no connection with Steering Post—the front wheels of the car are wild. Endorsed by Insurance Companies—approved by The Underwriters Laboratory, Police Departments, Automobile Engineers and owners. A Fire Insurance Policy and a "Perry" will save you 70% on your insurance.

$1000 CASH paid to any thief who steals a "Perry" Locked Car

Dealers—Sells on sight—each "Perry" sells another—write or wire for liberal contract.

"Perry" Lock your Ford and it can't be stolen

Works exactly like the "Perry" for other cars—the standard Ford Cap under steering wheel is replaced by the "Perry"—you can do it yourself in 15 minutes and your Ford will be safe from theft forever. 30% of all cars stolen are Fords—yours won't be next if it is "Perry" Locked.



$5 For Fords

Leave your Ford anywhere any time—it will be there perfectly safe when you come back—there is no other lock so safe and sure—it never fails.

Tear out the Coupon and send it by return mail—investigate, then decide.

Stop worrying —get a "Perry"

Simple in construction—positive in action—nothing to get out of order—no upkeep—no charge for installation—the "Perry" Lock has eight tumblers and cannot be picked. Lasts a lifetime—can be changed to any car.

Stop taking chances—the "Perry" will soon pay for itself—the price is within the reach of all—there is a "Perry" Lock for your car. At least investigate—lest ye forget—tear out this coupon and mail it NOW—no obligation on your part.

PERRY AUTO LOCK CO.,
Dept. G-1 1238-40 Michigan Blvd., Chicago

More Information Coupon

Perry Auto Lock Co., Dept. G-1
1238-40 Michigan Blvd., Chicago.

Gentlemen:—I own a ....car.
Send me a Descriptive Folder and give me name of nearest dealer—I am interested. No obligation on my part.

Name..

Address...

Tomorrow YOUR car may be stolen

KisselKar Prices

Will Advance December 1st

In order to maintain our present quality standard, and owing to well known causes—increased cost of raw material and other factors entering into the cost of production, the retail prices of the Kissel Pleasure Cars, including the *Hundred Point Six* and ALL-YEAR Car, will be advanced on December 1st.

KISSEL MOTOR CAR COMPANY

HARTFORD, WISCONSIN

GUARANTY PLAN
AUTOMOBILE Time Payments

It Costs Next to Nothing

GUARANTY PLAN
COMMERCIAL CAR Time Payments

An average of 27½ cents per day above ordinary banking and insurance charges will *store ten cars costing $1000. each at wholesale under the Guaranty Acceptance Plan.*

This opportunity to use this cheapest and most convenient financing for your Winter Storage will be held open but a short time longer. To get in on it, you must act now.

Write or wire how much you need and on what cars you wish to borrow—Also send name of distributor if not buying direct from factory.

GUARANTY SECURITIES CORPORATION

Incorporated under N. Y. State Banking Laws

Equitable Building **New York City**

SAN FRANCISCO
Hobart Building

MONTREAL
National Trust Building

Makes of cars represented	1	2	3
If you are distributor ✓ here			
If you are direct factory dealer ✓ here			
If you are sub-dealer ✓ here			
Name of Distributor			
Address of Distributor			
No. of cars 1917 Contract			
Desire financial assistance winter storage on cars amounting wholesale value	$	$	$
I {am using / will use} GUARANTY RETAIL PLAN on cars checked			

Signature..................................... *Address*.....................................

A. Nov.9

WITH BATTERIES

We will guarantee to start your engine, whether in a truck or pleasure car, direct on magneto with a

TRADE K-W MARK

NEW MODEL T OR TK MAGNETO

for multi-cylinder automobile and truck motors

These magnetos eliminate the necessity of a dual system. No matter how slowly you turn over your motor by hand, a Model T or TK Magneto will give you a hot spark and will fire any kind of fuel.

Model T is an independent high tension magneto, built especially for 4, 6, 8 and 12 cylinder motors. It operates on the well-known inductor principle, having stationary windings and revolving rotor.

The circuit breaker is extremely fast and will give 18,000 sparks per minute without missing. This is an equivalent of operating a 12-cylinder four-cycle motor at 3,000 r.p.m. It will also give a spark of great intensity at as low a speed as 60 r.p.m. Both the model T and TK Magneto conforms to all standard dimensions. It is entirely closed as protection against water, dirt and oil.

Being of the inductor type, it does away with all moving wires, special contacts, etc.

The impulse starter supplied with the Model TK holds back the rotor of the magneto until the firing point of the engine is reached. When it is tripped by means of the spring it is driven forward at a high rate of speed, producing a hot starting spark in the cylinder.

Manufacturers of trucks and pleasure cars and car owners who want an ignition system that is absolutely dependable and efficient should investigate these new K-W Magnetos.

Will be glad to furnish further information in detail regarding these new magnetos on request.

THE K-W IGNITION Co.
2833 Chester Ave. CLEVELAND, OHIO, U.S.A.

America's Greatest "Light Six"

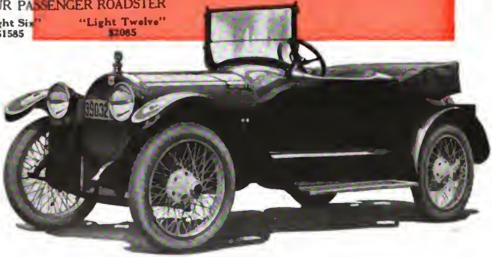
HAYNES

America's Greatest "Light Twelve"

Dealers who represent a seasoned concern with 24 years' manufacturing and merchandising experience in motoring affairs carry pretty good ballast. Their future success can be fairly accurately gauged by the uniform success of HAYNES dealers in the past.

A few new 1917 Dealerships are available now. Write, wire or call at the factory

THE HAYNES AUTOMOBILE CO.
3 S. Main Street Kokomo, Ind.



FOUR PASSENGER ROADSTER

"Light Six" $1585 "Light Twelve" $2085

LUBRICATION

POSITIVE and DEPENDABLE

The use of the Spillman 8 would be justified, because of the high efficiency of the oiling system, if the motor otherwise were very ordinary.

Lubrication has been one of the serious contentions in 8 cylinder construction. But Herschell-Spillman, through their wide experience in lubrication of high speed multi-cylinder aeroplane engines, have long since worked out a thoroughly efficient and dependable oiling system for motor car 8 cylinder motors.

In the particular model illustrated herewith the oil is delivered from the bottom of the oil pan by a positive gear driven pump through a passage extending lengthwise of the crankcase to each of the main bearings on the crankshaft, under pressure of from 10 to 50 pounds—this pressure varying, of course, with the speed of the motor. From each main bearing the oil is then forced through the hollow crankshaft to each connecting rod bearing, and then through a tube in each connecting rod to the wrist pin bearing, and thence to the cylinder walls themselves.

SPILLMAN "8"

The oil passage in the case is also connected with the three cam shaft bearings.

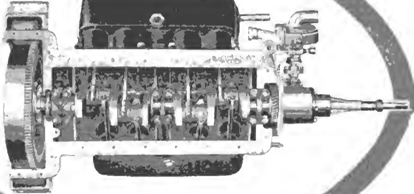
By the use of efficient oil retainers practically all the oil is returned to the oil pan where it is strained and circulated by the pump, thus assuring a positive supply of clean oil under pressure at every engine bearing.

A safety valve in the oil line at the forward left side of the motor delivers the overflow by a tube to the timing gears and regulates the oil pressure.

HERSCHELL-SPILLMAN CO.

NORTH TONAWANDA NEW YORK

We are building a large addition to our plant and are in shape to take on an order for three to ten thousand motors.



Celfor

Internal Gear Drive Axle

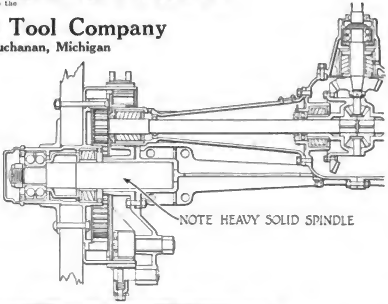
TWELVE TALKS TO ENGINEERS

Talk No. 5—Solid Wheel Spindles

The internal gear drive axle delivers the power to the truck wheels near their rims. It does not transmit power through the centers of the wheels. Therefore the wheel spindles are smaller than hollow spindles. The smaller spindles may run in smaller bearings with the same factor of safety. You know how rapidly bearing prices increase with size. The internal gear axle maker does not have the temptation to save money by using too small spindles and bearings. He can afford to be liberal. In fact, he can use excessive sizes of bearings without suffering by prohibitive cost.

This is one of a series of twelve engineering arguments. If you would like to have the whole set at once, write to the

Celfor Tool Company
Buchanan, Michigan



Gearsets, Clutches and Steering Gears

These three vitally important units of automobile construction will be featured interestingly in next week's issues of

The Automobile *Motor World*
Motor Age

The plan of special issues which exhaustively cover particular phases of interest has been accorded genuine appreciation by the engineering and manufacturing departments of the industry, by dealers and garage owners who sell and maintain the industry's products, and by car owners.

And because each of our three papers functions for a separate reader clientele, the necessity for a distinct difference of editorial treatment for the same subject in each paper is obvious. That is the reason for three papers. They develop three classes of interest, and can, therefore, be depended upon to render a more complete and satisfactory service to their respective classes than if attempt were made to publish a paper that would "blanket" all classes.

In the forthcoming special issues covering Gearsets, Clutches and Steering gears, The Automobile will feature the engineering and manufacturing phases for the advantage of engineers and manufacturers. Motor World will consider the subject from the interest point of car dealer, garage owner and repairman—maintenance, repair, adjustments, etc., Motor Age will present a wealth of information pertaining to the care necessary to give these parts by the car owner.

In our issues for the following week (Nov. 23) Solid and Pneumatic tires will be featured. Electric lighting and Starting will have the center of the stage in the issues of Nov. 30th, and in the issues of the succeeding week (Dec. 7) Ignition will be featured. In the Dec. 14 issues the subject of Carburetion will be covered thoroughly.

All of these special issues will be unusual in the matter of interest for the reader and, therefore, of particular value to advertisers.

The Class Journal Company

Publishers of

The Automobile *Motor World* *Motor Age*

NEW YORK
239 W. 39th St.

CHICAGO
Mallers Bldg.

Garagemen Write! → W'RIGHT COMPRESSION TIGHT PISTON RINGS ← **Repairmen Write!**

INSTALL THEM NOW!

DEALERS: The W'RIGHT Piston Ring business is booming. Your opportunity for selling W'RIGHT Rings to every car owner who comes into your place of business is greater now than ever.

One Half the Price of Ordinary Multiple Type Rings

Patent applied for

Note perfect simplicity—two perfect eccentric rings, slots cut right and left and kept separated to a position of 90° by a dowel pin—so that each ring seals the joint or slot in the opposing ring. Compression is held—oil cannot work past.

Without a Superior in Material, Workmanship or Performance

Consider that the low price of W'RIGHT Rings permits car owners to install a complete set of rings where otherwise they could use one or two high-priced rings at most to a piston.

Complete satisfaction is not to be obtained with anything less than a complete set of piston rings. W'RIGHT prices have been made low enough to stimulate complete set installation, in the knowledge that only by so doing can perfect results be assured.

Dealers are authorized to sell every complete set of W'RIGHT Piston Rings with the understanding that they can be returned at any time within 30 days for any reason whatever, and their full purchase price refunded. W'RIGHT RINGS can now be obtained at almost every live garage or repair shop.

This guarantee naturally applies only to W'RIGHT installation on pistons which are round and unscored.

W'RIGHT dealers report that they are smashing all previous sales records. The low price of W'RIGHT Rings, added to their exceptional qualities, give them the call. If you are not getting your share of the piston ring business in your vicinity, you are overlooking interesting profits in a big and growing business. Everything indicates that more W'RIGHT Piston Rings will be sold in 1917 than any other type of fuel economizer on the market.

Our factories are working overtime to meet the demand. If you recognize the big possibilities and the permanence of the W'RIGHT agency, we want you—now! Get in line for the spring trade. Every time that gasoline goes up, more W'RIGHT Rings will be sold. Wire, or use the coupon today for interesting dealers' proposition.

V. A. LONGAKER COMPANY

Sole Distributors

Suite 706, Merchants' Bank Bldg., Indianapolis, Ind.

DEALERS' COUPON

V. A. LONGAKER,
706 Merchants' Bank Bldg.,
Indianapolis, Ind.

Please send full details of special dealers' proposition.

Name ....

Address ....

....

PHILBRIN

IGNITION SYSTEMS

4 Cyl. 6 Cyl. 8 Cyl. 12 Cyl.

Enjoy the Luxury of Two Ignition Systems

Two complete, independent ignition systems in one.

Positive assurance against ignition failure—either system at your instant disposal by a turn of the switch.

In performance, we believe, this system possesses more distinct advantages and will deliver more uninterrupted satisfaction than any other ignition system in the world.

To appreciate its unfailing efficiency you must see it in action.

Makes Any Car a Better Car

It transforms an old motor completely. It enables it to take grades, heretofore impossible on high, swiftly, easily, without the slightest suggestion of laboring.

Abuse it—step on the throttle, throw it clear down as you've never dared before. The response is instantaneous; no slightest sign of choking, not even a falter—she gains her head smoothly, quietly, quickly.

But it is in everyday running that this system proves its metal.

You will be continually finding new things in its favor.

Its responsiveness, its flexibility, its economy of fuel consumption, its power, its unfailing sureness will cause you to value it at many times its original cost.

On difficult grades it fairly lifts the motor along and on the clear stretches she springs ahead as though there were no limit to her power.

For Cold Weather Driving

For cold weather driving, PHILBRIN Ignition has many distinct advantages.

By a turn of the switch a High Frequency system of ignition is brought into use—a system that distributes a "Shower of Sparks" of remarkable intensity to each cylinder in its firing order at the rate of sixty thousand sparks a minute.

No matter how cold the motor, it invariably capitulates before this system.

And not only is this system invaluable for starting in cold weather, but faulty carburetor adjustments, lean mixtures and fouled spark plugs give way before it.

Easily Attached—Moderate in Price

Run on either system you will. Each has its own individual advantages. Either system can be used continuously. Neither system will wear out before your car.

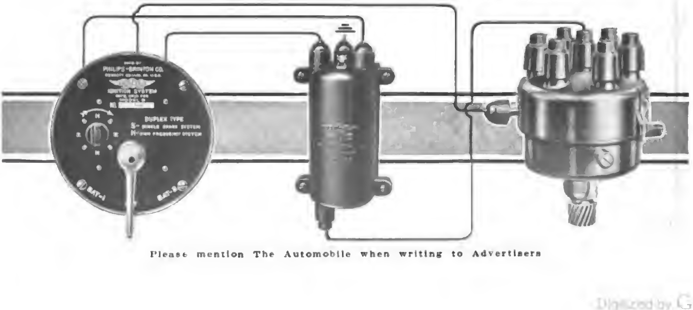
The current consumption of both systems is almost negligible, far smaller, we believe, that that consumed by any other battery system you have ever seen. A single set of dry cells will operate a 4 cyl. motor for months.

PHILBRIN "Duplex" ignition is built for 4 cyl., 6 cyl., 8 cyl. and 12 cyl. motors and can easily be attached to any car in place of the ignition system it now carries. Write for descriptive catalogue and prices.

DEALERS: Write for complete details, selling proposition, discounts, etc.

PHILIPS BRINTON COMPANY

501 South Broads, Kennet Square, Penna.



This Preference for Saxon "Six" Is Based Upon Very Definite Reasons

Throughout the country you will find a very marked preference for Saxon "Six" springing up among motor car buyers.

Unlike many preferences it is not flavored with prejudice, but has more the aspect of a conclusion in favor of Saxon "Six" arrived at unhurriedly after careful comparisons.

We have told you time and again that the Saxon "Six" motor—both because of its type and its high development—is far superior to a motor of fewer cylinders.

Evidently this statement has been confirmed by buyers themselves, for a census reveals that 75% of the owners turning in their cars for Saxon "Sixes" formerly drove cars of less than six cylinders.

The reason for this change is found in the superiority of the Saxon "Six" motor.

Between the power-impulses produced by a "less-than-six-cylinders" motor there are intervals. That is, a mechanical truth.

These intervals are responsible for vibration. And vibration is a dread danger to a motor.

It impairs flexibility, slows up acceleration, makes a difference of degrees in the quietness of operation, increases repair-service costs, and finally takes nearly 50% from the standard efficiency of the motor.

In the Saxon "Six" motor, on the contrary, you get a power-flow of uniform, constant torque, that is, perfect smoothness or continuity.

Vibration is practically nil. Briefly, that is why Saxon "Six" excels in pulling power, in acceleration, in high-gear work, in flexibility.

And that is why the cost of repairs on Saxon "Six" is so insignificant.

In this connection it is enlightening to note that the figures on the cost of all repair parts bought by all Saxon "Six" owners during the past two years show that the cost per car averaged $8.50.

You will find the value of the highly efficient Saxon "Six" motor demonstrated in another definite advantage.

And that is in respect to gasoline economy. It extracts full mileage from each drop of gasoline. 23.5 miles is the gallon average established recently by 206 stock model Saxon "Sixes" in a 300 mile non-stop run.

Still another motor advantage is found in the fact that you get higher maximum and lower minimum speed without vibration.

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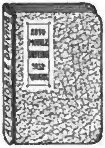

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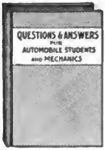

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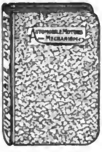

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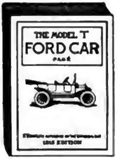

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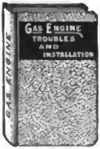

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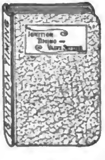

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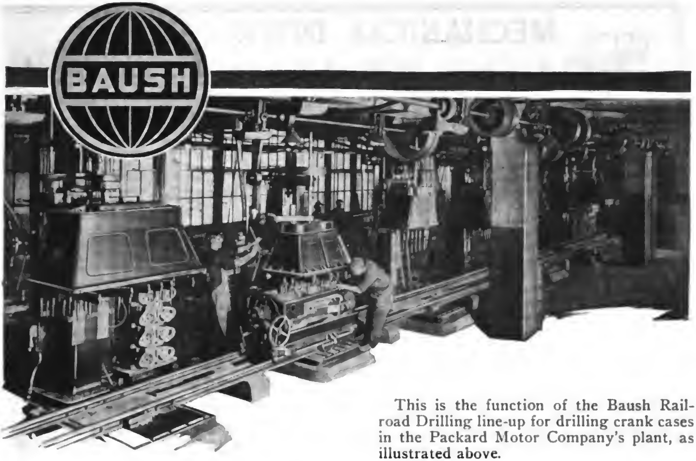

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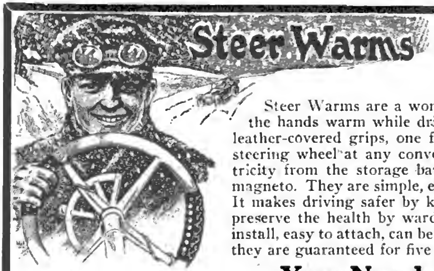

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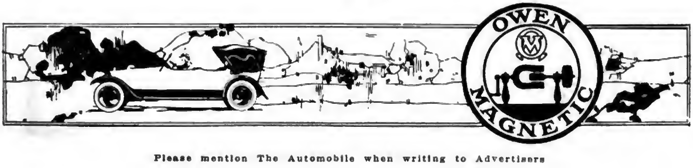

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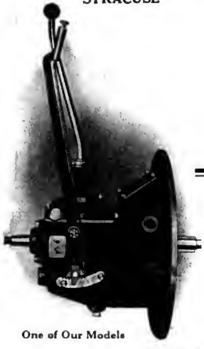

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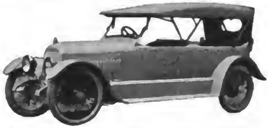

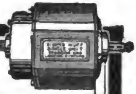

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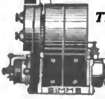

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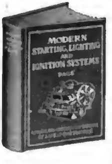

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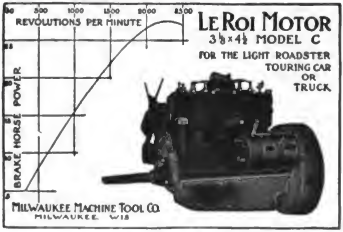

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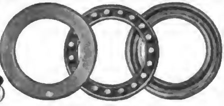

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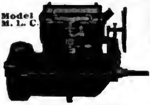

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are as superior in quality to ordinary tires, as the Combination liberal sales policy is superior to the "cut and dried" ordinary selling policy under which the ordinary tires are sold.

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The Combination Rubber Mfg. Co.

Manufacturers of High-grade Rubber Products for 50 Years

Trade Mark

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BEST UNDER A CAR BEST ON EARTH

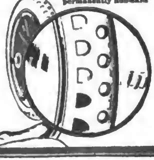
Will establish you in business on a permanent and profitable basis.

Our Policy:

One good dealer in each territory, backed by the best goods and unlimited co-operation.

New Jersey Car Spring & Rubber Company
Jersey City, New Jersey

Carspring Tires are permanently non-skid



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PROPELLERS

Salisbury Wheel & Mfg. Co.
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Electric
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Systems
SINGLE UNIT and
TWO UNIT Equipments

Booklet on Special Ford Equipment

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STEEL
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OR RUST
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THE WINKLEY CO., Detroit, Mich., U. S. A.
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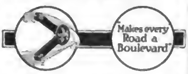
FROM MICHIGAN

The comfort of my car is undoubtedly very much enhanced by the addition of these absorbers

C.F. HUTCHINGS

*Hartford

SHOCK ABSORBER


"Makes every Road a Boulevard"

EDWARD V. HARTFORD Inc. { 144 MORGAN ST.
JERSEY CITY, N.J.

You don't just *expect* good service from

BRAENDER

TIRES & TUBES

—*you get it*

Write for particulars about BRAENDER "Bull-Dog" Non-Skid—THE FASTEST, SAFEST, SMOOTHEST RIDING TIRE MADE.

Braender Rubber & Tire Co.

Factory: Rutherford, N. J.

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675 *No. Broad St., Philadelphia, Pa.*
1350-54 *So. Michigan Ave., Chicago, Ill.*

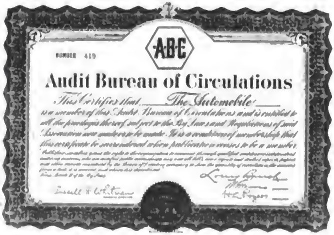
**BRAENDER
"Bull-Dog"
Non-Skid**

Trade Mark

Models—FOURS	Models—SIXES
Model N.....3½x5	Model 7W ...3½x4½
Model N.....3¾x5	Model 7N ...3½x5¼
Model C.....3¾x5¼	Model 6P 3¾x5¼
Model C.....4⅛x5¼	
Model E.....4½x5½	

"America's Standard Motor"

Continental Motors Company
Detroit—Muskegon, Mich.



NUMBER 419

A·B·C

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For Your Car

Atwater Kent Mfg. Works
Philadelphia, U.S.A.

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That Brings Down Gasoline Expense

New STROMBERG Does it!
CARBURETOR

PITTSFIELD TRADE MARK

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BERKSHIRE 96b
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It has an *extra long shell,* and the *specially imported Kaolin Porcelain* used in this plug was fired at extreme heat to *insure extraordinary durability.* Same *self-cleaning* design as standard plugs. Meteor wire, the highest grade alloy known for this duty, is used for sparking points.

PITTSFIELD SPARK COIL CO.
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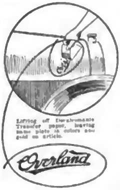
Lifting off Decalcomania Transfer paper, leaving name plate in colors and gold on article.

MEYERCORD
Decalcomania Transfer Name Plates

—will not tarnish, blacken, loosen, rattle or fall off. Unaffected by time, wear, tear, oil, water or grease. Simple to apply, decorative and permanent.

In use by leading automobile and accessory manufacturers, in place of brass name plates.

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Savings made please your patrons and pay good substantial profits

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The World's Largest Makers of Dissolved Acetylene

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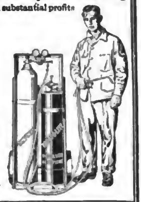

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For 1915-1916-1917 Ford Cars

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Stands up out of the cylinder, and is accessible with a wrench. Gets down into the explosion chamber and fires every charge.

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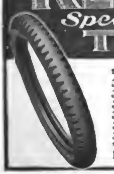

30 x 3	Non-Skid	$12.05
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32 x 3½	Non-Skid	17.95
33 x 4	Non-Skid	25.65
34 x 4	Non-Skid	26.20
36 x 4½	Non-Skid	36.95

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Broadway and 58th Street
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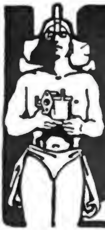

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26 YEARS EXPERIENCE
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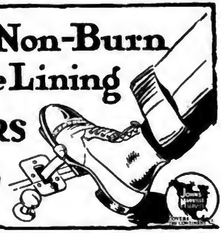

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METAL GEARS

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Cars equipped with Rockwood fibre friction drive are more flexible and use less gas per mile. There are no gears to strip or change. The speed variation is as simple as the advance of the throttle—an infinite number of speeds. Freedom from vibration means long motor life at minimum expense. Entire satisfaction.

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THE BIGGEST CAR IN THE LIGHT WEIGHT CLASS

$695

32 Horsepower, genuine cantilever springs. Big Body, Wide, Deep Seats. POWER and ENDURANCE.

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$1.25
Guaranteed For The Life of The Car

Other types for Fords and other cars, $0.75 and $1.00. Ask your dealer or write direct to the manufacturers.
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"The Exceptional Motor"

are so perfect in design, in materials, in workmanship that it costs us only 1/10th of 1% to make good on our guarantee. Write for catalog L which tells why.

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We buy in train load lots—Entire stock of automobile companies—Over two million parts on hand in our large plant and adjacent warehouses. We buy for Cash—and sell for Cash—Exceptionally low prices—You benefit.

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Everett 30 radiator	$22.50
Krit 1913 (used)	10.00
Northern, many models	15.00
Paige 36, 1913	22.50
Studebaker 25 radiator	22.50

AXLES

Front axle	10.00 up
Rear axles	35.00 up

Write us your requirements

BODIES

If you intend to overhaul your car this winter, plan putting on a new body. A new body will change the appearance of your car, it will make it look like new. We have different types and styles of bodies upholstered and painted. Prices from............$15.00 to 75.00

Write us for measurement chart. Will be pleased to quote you prices on a new body for your car.

We can also furnish bodies with tops, fenders, running boards and windshields complete, at a small additional cost.

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If you want a good little motor for a light weight car, write us for specifications on this Perkins 18 H.P. motor, complete with carburetor, for 60.00

PURITAN TOPS

Puritan tops are made for practically every make and model of car now running. Tops will be strong, durable. You will be surprised at the small cost as well as the marked improvement in the appearance of your car. We have one man mohair tops that will fit the following cars:

Overland 75.
Dort 1914.
King 4 cylinder.
Maxwell model 25—1914.

Including dust boots and inside curtains for 30.00

(Write us for top chart)

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Right and left hand drive Jacox steering gears	10.00
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Any type or size, fit practically any car for. 3.00

FRAMES

All sizes, price.......... 10.00

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Many makes of wheels, all sizes.......... 3.00

MISCELLANEOUS

Holly and Kingston Carburetors for Fords, each	5.40
Electric head light dimmers for Ford, each	3.00
Put a set of Puritan shock absorbers on your car. Made on correct principles. Absolutely takes up all vibration and shocks. Set of four	12.00

(Fittings extra)

RIMS

34 x 4 Detroit Clincher	2.70
32 x 3½ Detroit Clincher	2.40
32 x 3½ 1912 Detroit Straight side	2.40
30 x 3½ 1912 Detroit Straight side	2.40
36 x 4 1912 Detroit Straight side	2.70

Write for a copy of our Illustrated Bargain Bulletin. It contains many bargains, not listed here. Reference to this book when ordering auto parts or accessories, will save you money.

Puritan Machine Company

ALL PARTS FOR ALL CARS

408 Lafayette Blvd. Detroit, U. S. A.

See our ad on page 96.

TIRES

Our Guarantee Is Permanent —Our Reputation Established

3500 Mile Guaranteed

Tires and Tubes

bought at a tremendous discount at an excess sale of one of the country's best known manufacturers. All fresh selected stock—standard make, at prices you can't afford to overlook.

Size	New Tires	New Tubes
28x3	$ 6.00	$1.25
30x3	6.50	2.00
30x3½	8.00	2.25
31x3½	8.50	2.50
32x3½	9.00	2.50
34x3½	9.50	2.55
36x3½	10.75	2.75
31x4	11.75	2.90
32x4	12.50	3.20
33x4	12.75	3.25
34x4	13.25	3.35
35x4	13.50	3.45
35x4½	17.00	4.15
36x4½	17.50	4.25
37x4½	18.00	4.35
35x5	17.50	5.00
36x5	18.50	5.00
37x5	20.00	5.20

Add 10% to the above prices for non-skid

Special Bargains in Slightly Used and Demonstrating Tires

Size	Used Tires	Used Tubes
30x3	$ 3.50	$1.35
30x3½	4.25	1.45
31x3½	4.50	1.50
32x3½	5.25	1.50
34x3½	5.50	1.60
31x4	6.25	1.65
32x4	7.00	1.60
33x4	7.25	1.70
34x4	7.75	1.70
35x4	7.50	1.75
36x4	7.50	1.75
34x4½	8.00	1.75
35x4½	8.00	1.80
36x4½	8.25	1.85
37x4½	9.50	1.90
35x5	8.50	2.00
36x5	9.50	2.00
37x5	9.75	2.20

We guarantee all tires sold by us at the above prices to be free from imperfections in material and workmanship. Send one dollar deposit with each tire ordered. Tires will be sent promptly C. O. D., with privilege of examination. Specify style of rim to avoid delay.

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All Service Parts for All Cars

It's rather a broad statement isn't it? But we can back it up by our large stock. We can supply parts for over 100 "ORPHAN" Automobile Companies and can also supply practically any part for any car. Below is a partial list of "ORPHAN" Cars for which we can supply prompt and efficient service.

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Lion
Marquette
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R-C-H Car

AND MANY OTHERS

If your car is not listed, write us. Come to the Puritan FIRST when you need repair parts or service parts for your car. We assure you our prices will be low and will give you prompt and efficient service. Write us for our large Illustrated Bargain Bulletin. It contains items of interest to every motorist.

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All Parts For All Cars

408 Lafayette Blvd. Detroit, U. S. A.

See our ad on page 96.

Manufacturers Attention

These goods were purchased fron an over-stocked company. We wish to make quick sales. That accounts for the low prices.

About

50 Truck frames	$20.00
250 Truck wheels	3.00
100 Truck steering gears	12.00
50 6-cyl. motors	150.00
100 4-cyl. motors	125.00
150 Shaft drive rear axles	30.00
200 I-Beam front axles	15.00
50 Transmissions	35.00
50 Upholstered five passenger bodies	50.00
25 Delivery bodies	35.00
100 One ton rear axles	22.00
70 Bosch magnetos	22.50
100 Truck radiators	18.00

Special prices in quantity lots

Auto Parts Co., 741 W. Jackson Blvd., Chicago, Ill.

G-E-A-R-S

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Write our sales department about your requirements.

Manufacturers for the Trade

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Imported make
All sizes in stock
Immediate delivery

SCHAFER SALES COMPANY
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The Auto Parts Co. of Chicago has a well-earned reputation for quoting the lowest prices and offering the quickest service of any concern in this line of business.

Scores of other concerns are now conveying the impression, whether intentionally or otherwise, that they are branches of this big corporation by operating under a name similar to this one.

The Original and Largest AUTO PARTS CO. Has No Branches

The original and only house we have is located at the address given below. Our business has grown from a small three clerk store to an immense seven-story structure through our ability to give better bargains and better service than can be obtained elsewhere. Our policy of buying parts from only original companies and only absolutely new goods, makes us particularly anxious to establish the fact that we are in no way connected with concerns which make a practice of dismantling cars and selling old parts. The bargains which we offer are genuine and just as represented. But to protect your order, remember we have no branch houses. Orders must be sent direct to the address given below.

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The Motor Mica Co. recently went into the hands of the receiver. "NUFF SED." We can offer some more real bargains.

5000 cans tire mica	each	$0.05

The following can be compared very favorably with graphite when lubricating qualities are concerned.

500 cans Motor mica, ¾ oz.	each	$0.05
1000 cans Motor mica, ½ lb.	each	.10
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50 cans 5 lb. mica grease	each	.35
50 cans 10 lb. mica grease	each	.60
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500 ft. 1¼ lb. flexible hot air tubing	per ft	.15
500 ft. 1½ lb. flexible hot air tubing	per ft.	.20
500 ft. 1¾ lb. flexible hot air tubing	per ft.	.25
500 ft. 2 lb. flexible hot air tubing	per ft.	.30
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MICHIGAN LOZIER
MORA DRAGON

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for over 100 MAKES OF CARS

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Of 50% to 75%

Our Assortment includes wheels, axles, gears, bearings, cylinders, pistons, crank cases, transmission cases, etc., for nearly all standard makes of cars. Get our prices before placing your order.

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Headquarters for Automobile Parts.

MAKE YOUR FORD A ONE-TON DELIVERY

COMPLETE SET OF PARTS, MACHINED....... **$175.00**

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CONNECTICUT IGNITION SYSTEMS

including timer, coil and switch for Maxwells, Chevrolets and Dort cars, $6.00.

25—1916 Maxwell Winter tops, $95.00 while they last.

Splitdorf magnetos, Model X, $9.00.

Another lot of Prest-O-Lite tanks, Model B, $7.00; Model E, $6.00.

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We have a large assortment of TOURING BODIES that we will close out at very low prices. We can fit most any car—prices range from $10.00 to $40.00. Write for particulars.

The M & M Company
Cleveland, Ohio

AUTOMOBILE PARTS

SAVE 50% AND MORE

WE HAVE PARTS FOR MOST ALL STANDARD MAKES OF CARS. WRITE US YOUR NEEDS.

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Engines, Gears, Bearings, Axles, Crank Shafts, Cylinders, Transmissions, Hubs, Wheels for most any make of car.

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Bosch Magnetos sold with six months guarantee
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30 x 3½	6.95	7.50	2.15
32 x 3½	7.95	8.75	2.25
34 x 3½	8.85	9.75	2.35
31 x 4	9.65	10.60	2.95
33 x 4	9.85	10.85	3.10
34 x 4	9.95	10.95	3.20
36 x 4	10.95	11.95	3.35
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32x3½	7.35	36x4½	11.75
34x3½	8.00	37x4½	12.20
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35x4½	17.50	4.15
36x4½	18.00	4.25
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32x4	6.25	1.30
34x4	7.00	1.50
40x4	8.75	1.75
32x4½	7.00	1.60
34x4½	7.10	1.75
36x4½	7.50	1.80
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Mfg. complete Welding, Cutting Equipment and Supplies. Equipment guaranteed to be the best or money refunded. We weld all broken Automobile, Machinery or Boiler parts.

A BIG GUARANTEE—Trial Bar and full directions 50c. So-Luminum saves all aluminum parts. Absolutely excels Acetylene method. Use gasoline torch—no flux. Booklet 33—Ask for it.
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1790 Broadway, N. Y.

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THE AUTOMOBILE
$3.00 a Year

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Are you having trouble with springs?
50 years experience in designing and manufacturing commercial vehicle springs.
THE E. R. MERRILL SPRING CO.
526-532 W. 28th Street New York City
Established in 1863

AUTOMOBILE Body Sheets
Also materials for Tanks, Hoods, Guards, Fenders, Radiators, Frames, Etc. "THURITE" Deep Drawing Stock, Enameling and Japanning Stocks, Roofing Products, Etc.
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BROWN Impulse Tire Pump
Why bother with gears, brackets, etc., when a Brown Pump can be attached to your motor in an instant and always ready for use.
Outfit is complete with Q.D. Plug, hose, gauge, etc.
Price $12.00. Send for leaflet.
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CULLMAN
Sprockets and Differentials
In stock and to order. Send for Catalog.
CULLMAN WHEEL COMPANY
1347 Altgeld Street, Chicago

PRESSED STEEL FRAMES
Rear Axle Housings—Drop Forgings
Heavy Stampings
A·O·SMITH COMPANY·
Milwaukee

Guaranteed
Forgings

The
Wyman & Gordon Co.
Worcester Cleveland Detroit

PAXSON - WARREN SAND BLAST MACHINERY

36" Diameter x 48"
Sand Blast
Tumbling Barrels

With two single hose sand blast machines, suction elevating set and sand seperator; hoppers are shown below floor, but can be placed entirely above floor if desired.

Complete Sand Blast Plants with Bucket or Suction Elevators and Dust Arresters can be furnished. Correspondence giving requirements solicited.

FOUR
OUTFITS

Recently
furnished to
Dodge
Brothers.
Similar to cut,
with hoppers
above floor

J. W. PAXSON CO.
Foundry Outfitters
PHILA. PENNA.

Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

American Sheet & Tinplate Co..........101
American Vanadium Co..........60
Atwater Kent Mfg. Works..........92

B

Baker R & L Co..........85
Bausch Machine Tool Co..........83
Bearings Co. of America..........90
Beaver Mfg. Co..........91
Bosch Magneto Co..........95
Bound-Brook Oilless Bearing Co..........51
Bower Roller Bearing Co..........1
Braender Rubber & Tire Co..........92
Brown Co. 101
Brown-Lipe Gear Co..........91
Buda Company 48

C

Case, T. M. Co., J. I..........57
Cassidy, E. A..........70
Celfor Tool Company..........77
Central Steel Company..........104
Champion Ignition Co..........87
Columbia Axle Company..........50
Combination Rubber Mfg. Co..........91
Continental Motors Co..........92
Corcoran-Victor Co. 90
Cullman Wheel Co..........101

D

Doehler Die Casting Co..........103
Durston Gear Company..........86
Dyneto Electric Co..........92

E

Eclipse Machine Co..........88
Edmunds & Jones Corp..........91
Eisemann Magneto Co..........88
Electric Auto Lite Co..........94

F

Firestone Tire & Rubber Co..........64
Foster Accessories Co..........89

G

Gibson-Hollister Mfg. Co..........95
Gray & Davis, Inc..........Front Cover
Grossman Mfg. Co., Emil..........93
Guaranty Securities Corp..........73
Gulf Refining Co..........58

H

Hartford, E. V., Inc..........92
Hawthorne Mfg. Co..........66-67
Hayes-Diefenderfor Co 62-63
Haynes Auto Company..........75
Herschell-Spillman Co. 76
Houk Mfg. Co..........94
Hyatt Roller Bearing Co..........93

I

Indiana Rubber & Ins. Wire Co..........90
Interstate Electric Co..........84

J

Johns-Manville Co., H. W..........95
Johnson & Son, S. C..........59

Index to Advertisers

K

Keystone Vehicle Co. 86
Kissel Motor Car Co. 72
K-W Ignition Co. 74

L

Liberty Motor Car Co. 90
Longaker Co., V. A. 79

M

Mercer Automobile Co. 91
Merrill Spring Co., E. R. 101
Meyercord Company 93
Michelin Tire Co. 53-56
Milwaukee Machine Tool Co. 90
Moon Motor Car Co. 3rd Cover
Motor Age 90
Motor World 94
Mutty Co., L. J. 87

N

National Motor Vehicle Co. 47
National Rubber Co. 93
New Departure Mfg. Co. 2
New Process Gear Co. 95
N. J. Car Spring & Rubber Co. 91
N. Y. & N. J. Lubricant Co. 89

P

Parish & Bingham 94
Paxson Co., J. W. 102
Perlman Rim Corp. 94
Perry Auto Lock Co. 71
Pfau Mfg. Co. 89
Philips-Brenton Co. 80
Pittsfield Spark Coil Co. 93
Prest-O-Lite Co. 93

R

Regal Motor Car Company 95
Remy Electric Co. Back Cover
Rockwood Mfg. Co. 95
Russell Motor Axle Co. 94

S

Salisbury Wheel & Mfg. Co. 91
Saxon Motor Co. 81
Sheldon Axle & Spring Co. 93
Simms Magneto Co. 86
Smith Co., A. O. 101
Splitdorf Electric Co. 88
Stanley Motor Carriage Co. 61
Stewart-Warner Speedometer Corp. 2nd Cover
Stromberg Motor Devices Co. 92
Studebaker Corp. 4

U

U. S. Ball Bearing Mfg. Co. 69
United Alloy Steel Corp. 65
United Smelting & Aluminum Co. 103

W

Wadsworth Mfg. Co. 93
Waltham Watch Co. 49
Ward Leonard Electric Co. 95
Waukesha Motor Co. 95
Weston Electric Instrument Co. 91
Wiedley Motor Co. 52
Willard Storage Battery Co. 88
Winkley Co. 92
Wisconsin Motor Mfg. Co. 94
Wyman & Gordon Co. 102

Z

Zapon Leather Cloth Co. 84
Zenith Carburetor Co. 94

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DIE-CASTINGS

are the standard of comparison in the ever-growing die-casting field. Their consistent use by the representative manufacturers of Automobiles and Automobile Accessories attest to the merits of the DOEHLER product.

The DOEHLER die-cast control housing here illustrated will be easily recognized as used on one of the best known of the highest grade cars made.

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NEWARK. N.J. TOLEDO. OHIO.

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Owing to a special order on our books, we can use for immediate also deliveries extending over the balance of the present year:

Aluminum Clippings, Aluminum Cable, Aluminum Wire and Sheets and all forms of Pure Aluminum Scrap.

Advise quantities and deliveries.

Address all replies Dept. X78.

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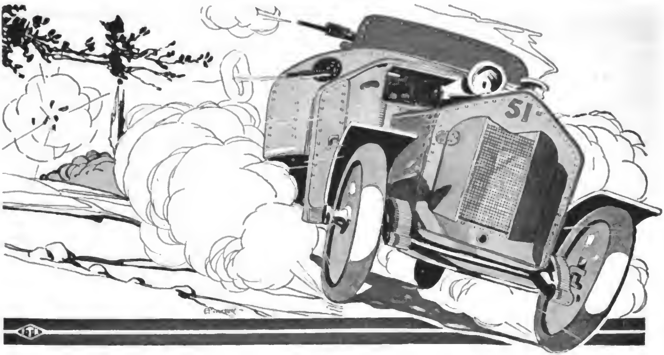

AGATHON STEELS

are made *for all purposes where dependable service is required.*

The *axles,* the *crank* and *drive shafts,* the *connecting rods* and all other parts of automobiles and auto-trucks of all descriptions that are subject to severe strains, should be made of *Agathon Steels.*

From the selection of raw materials, to the very last of the numerous processes necessary in attaining "Agathon" quality, we conduct exhaustive tests, to make positive that a state of perfection will be reached.

Furthermore, we preserve a test bar of every order we fill, thus insuring our patrons *exact* duplication of any metal they wish replenished.

MAKE IT OF "AGATHON"

OUR PRODUCTS

"AGATHON" Chrome Nickel
"AGATHON" Chrome Steel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steel
"AGATHON" Special Analyses
"AGATHON" Vanadium
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AGATHON STEELS
TRADE MARK

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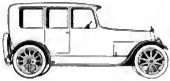
REG. U.S. PAT. OFF.
MOON MOTOR CAR CO.
ST. LOUIS, MO. U.S.A.

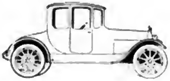
New Moon Closed Cars

The Embodiment of Luxury

In their very smartness—their singularly graceful lines and beautiful finish—the new Moon Closed Cars are sure to meet with your unqualified approval. Both within and without there is a strong appeal to your sense of the exquisitely complete. From deep, luxurious upholstery and comfortable roominess down to the veriest detail, every refinement is included.

These new Closed Cars are as strikingly advanced as the new 1917 Moon Touring Cars, with their European model Delaunay-Belleville bodies. They are, indeed, the season's Closed Cars DeLuxe.





Six-43 Cabriolet
Four Passenger, $1850

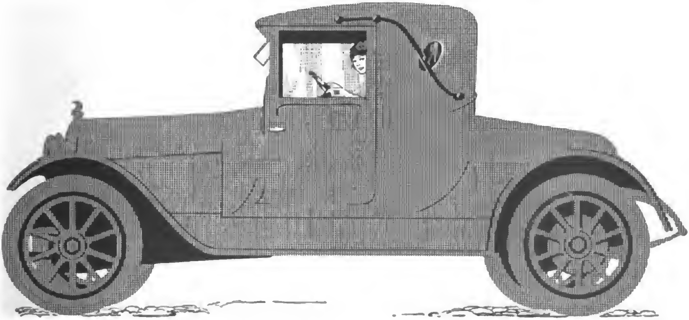
Six-66 Cabriolet
Four Passenger, $2150

Six-66 Touring
Five Passenger (demountable top), $1450

Six-66 Coupe
Four Passenger, $2150

Six-66 Sedan
Seven Passenger, $2250

MOON MOTOR CAR COMPANY ST. LOUIS, U. S. A.



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Starting Ignition Lighting

An integral part, year after year, of America's foremost cars.

Remy Electric Co.

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Gearsets, Clutches and Steering Gears

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The AUTOMOBILE

Vol. XXXV
No. 20

NEW YORK, NOVEMBER 16, 1916

Ten cents a copy
Three dollars a year

Maud L'Anphere Crook

The Double Continental Power

The power of Continental Motors is two-fold. From the very beginning, these motors have been noteworthy because of their efficiency. The power they developed was always adequate, and whether in pleasure car or motor truck, these motors have squarely met all demands made upon them.

Out of this physical power has arisen another force even more potent. It is the power of Continental reputation. Years of satisfaction on the part of the public has developed a strong demand for this motor in automobiles and trucks. Today dealers in Continental-equipped motor vehicles recognize a great force working constantly for their benefit—Continental sales-power.

CONTINENTAL MOTORS COMPANY

Offices:
Detroit, Mich.

Factories:
Detroit—Muskegon

Largest exclusive motor manufacturers in the world.

Continental Motors

Editorial Contents, Page 3

Advertisers' Index—Next to last page

STRONGER THAN EVER

Over 95 per cent of the equipped automobiles going into use this coming year will carry the Stewart Speedometer. Be sure it is on your car.

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart
Speedometer

The Crane PATENTED PUMP Belongs Here

Oilless Air
32% More Efficient
No Leaky Piston Rings

CRANE ENGINE DRIVEN PUMPS should be listed in every jobber's catalog. They are built on a principle that is different and that commends itself to the dealer and the consumer.

The CRANE PUMP is built with a special alloy packing-ring instead of the usual leaky, fast-wearing piston ring. Oil cannot get into the air pumped by a CRANE. Dealers and customers know the advantages of this as well as you do.

SEE THE WAY IT IS BUILT!
THINK HOW IT WILL SELL!

Cylinders and pistons are made of tough, light, pressed-steel and are ground carefully to size. Connecting rods are made from high quality bearing metal, carefully machined and broached. Bearings are as nearly frictionless as possible. Splash oiling, the system voted most efficient by Automobile Engineers, is used and the patented packing ring prevents any oil from entering air-chamber.

This pump will fill a tire in one-half the time taken by any other pump of its displacement. Its installation is simple, a special bracket makes it easier. A visible pressure gauge, located at the discharge end of the supply hose, guards tires against bursting.

Don't you think such a pump, retailing at $8, BELONGS in your catalog?

Our extensive advertising campaign which starts January 1st and continues throughout the year in the Leading Automobile Publications will create a constant demand for CRANE ENGINE DRIVEN TIRE PUMPS.

We furnish *CRANE* engine driven tire pumps complete with attachments on the following cars:

Ford all models.
Buick C 24-25.
Buick C 36-37.
Buick D 44.
Buick D 45.
Chandler 1914 15-16-17.
Dodge 1915-16 with magneto
Hupmobile model K.
Jeffrey 4-1916, 472-1917.
Maxwell 1916-1917.
Overland 59-69-79.
Overland 80-81.
Overland 83-83B.
Overland 84.
Reo 1912 to 1914.
Reo 1915-1916.
Reo model F 1917.
Studebaker 4 and 6 cylinder 1915.
Chevrolet H1-H2-H3-H4-1915.
Chevrolet H1-H2-H3-H4-1916.
Jackson 34.
Jackson 46.
Oakland 38.
Hudson Super Six.
Hudson 6-40-1915-1916.
Oldsmobile 43.
Kissel Kar 6-42.
Kissel Kar 38 or 100 point 6
Hollier 6 cylinder 1917.
Davis model G 1916-1917.
Bour-Davis 1916-1917.
Empire 1916-Six.
Velie model 22 1916.
Velie model 28 1917.
Paterson 4-33-1914.
Paterson 6 1915.
Paterson 6-42 1916.
Grant T & V 1915-1916.
Grant K 1917.
Abbott-Detroit 1916-1917.

seconds. Furnished in 4-18 and
o pump. $1.50 extra

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Crane
PATENTED

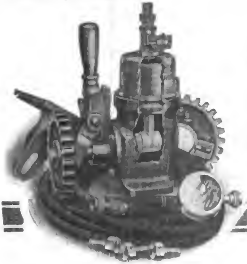
Engine Driven Tire Pump

The CRANE PUMP fills your tire in half the time taken by any other pump of its size. The use of patent packing ring prevents the leaking of oil into your tires.

This pump can be installed on your car in a few moments.

Complete outfit of pump, bracket, supply hose and easy-to-read pressure gauge.

Price.............................$8.00



Manufactured by

BAY STATE
PUMP
COMPANY

275 Congress St.

BOSTON, MASS.
U. S. A.

JOHNNY AITKEN

Winner of Harkness Gold Trophy 100 Mile Race, in Peugeot, Oct. 28

Broke American Record Averaging 105.95 Miles per hour

Galvin driving Premier was Second and Wilcox in Peugeot Won Third place.

Aitken, Galvin and **Wilcox Use**

The Incomparable Motor Oil

Oilzum

The Three Drivers having the Greatest Number of Points to their Credit as Candidates for the Title of

CHAMPION DRIVER OF 1916

AITKEN, RESTA and RICKENBACHER

Are Constant and Exclusive Users of

Oilzum

The **Motor Oil** that Resists the Heat, Remains and Lubricates Longer and Better, Increases Power, Induces Smooth, Quiet Running, Reduces Oil Consumption, Prevents Smoke and Minimizes Carbon Troubles.

Send for Booklet "Crystal Clear" and Attractive Race Poster

THE WHITE & BAGLEY COMPANY, Manufacturers

WORCESTER, MASS., U. S. A.

DISTRIBUTORS

Western Rubber & Supply Co., Los Angeles, Pasadena, San Diego, Cal.
Edwin F. Merry, Van Ness Ave. & Hayes St., San Francisco, Cal.
Shaffer Supply Company, Denver, Colo.
Universal Auto Company, Hartford, Conn
The Jordan Auto Company, Willimantic, Conn.
Western Supply Co., Boise, Idaho.
Wilcox & Herr, Inc., Indianapolis, Ind.
Western Auto Specialty Co., Iowa City, Iowa.
Bennett Auto Supply Co., Sioux City, Iowa.
Darling Automobile Company, Auburn, Me.
Green & Swett Co., 821 Boylston St., Boston, Mass.
The Tarbell Watters Co., Springfield, Mass.
Kansas City Automobile Supply Company, Kansas City, Mo
The Francis Motor Sales Co., Milford and Oneonta, N. Y.
Whittemore-Sim Co., 1976 Broadway, New York, N. Y.
A. H. Marshall Co., Inc., Plattsburgh, N. Y
G. M. Tee Water & Co., Cincinnati, Ohio.
Rasmussen & Company, Portland, Ore.
Cobali Motor Supply Co., S. W. Cor. Broad and Parrish Sts., Philadelphia, Pa.
Goodby-Rankin Company, 57 Washington St., Providence, R. I.
The Cameron & Barkley Co., Charleston, S. C.
Merchants Auto Storage Co., 18 So. Fourth St., Memphis, Tenn.
W. T. Wroe & Sons, Austin, Tex.
Sanders Bros. Co., Richmond, Va.
Comet Motor Co., Ltd., Montreal, Quebec.
Michael Ert, Ltd., Winnipeg, Can.
John Danks & Son, Pty., Ltd., 391-403 Bourke St., Melbourne, Australia.
Cornell, Limited, Adelaide, South Australia.
Empire Oil Co., Wellington, New Zealand.

The AUTOMOBILE
THE CLASS JOURNAL COMPANY
231—241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, NOVEMBER 16, 1916 No. 20

Important Trade News of the Week 827-837
Editorials 838
Steering Gears Offer Many Opportunities 839
Gearsets Simplified and Refined 843
Clutch Design Greatly Improved 848
German Truck Design Is Improved 850
Hudson Fits Dash Radiator Control 853
Motion Study as a Production Factor 854
Knox Aviation Twelve Tested 856
1917 Princess Is Larger 860
Two New Jeffery Sedans 862
Accessories 863
Industrial Miscellany 865
The Automobile Calendar 865

Index to Advertisers **96-97**

One manufacturer may err in judgment, but a large number of manufacturers are not likely to make the same mistake. When the majority of the makers of a machine of a certain class agree in their approval of a certain feature of their several constructions, that particular feature is quite likely to be as near right as such a device can be made.

"NORMA"
BALL
BEARINGS
PATENTED

The manufacturers of probably 85 per cent of the high grade ignition apparatus, lighting generators and starting motors made in America today, have agreed upon "NORMA" Bearings as the best bearings for their product.

Are you "NORMA"-Wise?

Why I am a Studebaker Dealer

Ten years ago we bought and built our present building. During that period, and until taking on the Studebaker line of motor cars, we had at various times attempted to handle other factory agencies, but generally in a subordinate way only. In each instance we found that our balances were in red figures when we closed the account.

We are now in our fourth season with Studebaker and if the Studebaker Corporation continues to show the ability to keep its fingers on the pulse of the sales market, as it has done in the past, we hope we shall be its representative in Northern New Jersey on our 24th anniversary as well as on our 4th.

R A Greene

President, Greene Motor Car Co.
Newark, N. J.

HERE again is a Studebaker representative who bases his preference for the Studebaker line on the fact that it embodies those principles of quality and construction which are most desired by the purchaser.

Add to that, the fact that the Studebaker Car gives more value per dollar of cost than any other high grade, medium priced motor, and you have the big reason for Studebaker dealer success. Not ordinary success, but the kind that outsells competition almost two to one because half the selling resistance is beaten down before you approach your prospect. After that, it is mainly a matter of salesmanship wherein Studebaker cooperative selling service has made itself felt in more than a few cases.

Mr. Greene first "sounded" Studebaker—then lined his company up under the Studebaker emblem. The motives that prompted this step might prove interesting reading for you. Write for these and other facts.

STUDEBAKER

South Bend, Indiana **Detroit, Michigan** **Walkerville, Ontario**

Address all correspondence to Detroit

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 16, 1916—CHICAGO NO. 20

G. M. C. Earnings Break Record

Approximately $25,000,000 Cash on Hand—Buick Builds 400 Cars Daily

DETROIT, MICH., Nov. 15—October earnings of the General Motors Co. were the largest in its history, the treasurer reporting approximately $25,000,000 cash on hand. The Buick Motor Co., its largest subsidiary, is turning out 400 cars daily.

Cole Price Raised $100

DETROIT, MICH., Nov. 13—The Cole Motor Car Co. will raise the price of its eight-cylinder car $100, to $1,685, on the touring and roadster models. This change will go into effect Jan. 1.

Kissel To Raise Prices Dec. 1

HARTFORD, Wis., Nov. 13—The Kissel Motor Car Co., this city, will raise the prices of its Hundred Point Six models on Dec. 1.

Leonard Leaves Perfection Spring

CLEVELAND, OHIO, Nov. 15—Z. B. Leonard has resigned as chief of the laboratory of the Perfection Spring Co.

Belden Overland Chief Engineer

TOLEDO, OHIO, Nov. 10—Edward H. Belden has been appointed chief engineer of the Willys-Overland Co. this city. For the past 2 years Mr. Belden has been consulting engineer of the Packard Motor Car Co., Detroit.

Mr. Belden, who was born in 1868 at Jackson, Mich., began his business career as mechanical engineer with the McCormick Harvester Co., later becoming electrical engineer of the Fort Wayne Electric Co. and subsequently holding the same position with the Westinghouse Electric & Mfg. Co. Mr. Belden has been designing automobiles since 1905. In 1913 he was president and engineer of the Belden Engineering Co. and in 1914 became connected with the Packard Motor Car Co. He built one of the first six-cylinder motors constructed in this country and has been a member of the Society of Automobile Engineers since 1913.

Smith Form-A-Truck Co. Sold

CHICAGO, ILL., Nov. 15—The Smith Form-A-Truck Co., this city, maker of a motor truck unit that can be attached to the chassis of a low-priced car, has been acquired by Michaelis & Co. and affiliated interests. It is stated that the demand for the product is ahead of the present output, which will be immediately increased and additional buildings will be at once arranged for. The total sales for this year will reach approximately $3,000,000 and the net earnings will amount to at least $1,000,000.

Steenstrup with General Motors Export

DETROIT, MICH., Nov. 14—Peter S. Steenstrup has joined the General Motors Export Co., succeeding O. G. Bennett, who has resigned to embark in a new venture for himself. Mr. Steenstrup was formerly the general foreign representative for the Hupp Motor Car Co. and spent the past 3 years abroad studying conditions in South America and in Europe.

Abbott to Build in Cleveland

CLEVELAND, OHIO, Nov. 9—The Abbott Corp. has applied for a building permit to construct a $110,000 plant at 1131 East 152d Street, covering a ground space of 110 by 681 ft.

10,000 Regals Planned for 1917

Co. to Concentrate on De Luxe Eight and J. Models—To Discontinue Others

DETROIT, MICH., Nov. 15—The Regal Motor Car Co. production department is planning on an output of 10,000 cars for the 1917 season. The company will concentrate on model J and the De Luxe eight-cylinder type, dropping all other models. Enlarging the 1917 output to 10,000 cars represents almost 100 per cent increase over the production for the 1916 manufacturing season.

Humphrey Now in Detroit

DETROIT, MICH., Nov. 14—S. H. Humphrey, who resigned as vice-president in charge of production with the Chalmers company to become the vice-president in charge of manufacturing for the Briscoe Motor Corp., has resigned the latter position and returned to Detroit to engage in business for himself.

Whitman National Production Engineer

DETROIT, MICH., Nov. 14—F. H. Whitman has been appointed production engineer for the National Motor Vehicle Co. at Indianapolis. Mr. Whitman was formerly connected with Dodge Bros.

International Truck Incorporated

ALBANY, N. Y., Nov. 9—The International Motor Truck Corp., as a result of the recent refinancing, has been formed and will carry on business with $7,372,790. The capital consists of 71,043 shares of $100 each and 53,638 shares of no par value. The directors are A. E. Moore, G. F. Jebbitt, T. S. Buckingham.

Cummins-Monitor Reorganized

Monitor Motor Car Co. Formed—$1,000,000 Capital Planned for Near Future

COLUMBUS, OHIO, Nov. 11—A complete reorganization of the Cummins-Monitor Co., this city, makers of Monitors has been effected by the incorporation of the Monitor Motor Car Co. with a preliminary capital of $10,000. This capital will be increased to $1,000,000 in the near future, a large part of which will be paid in. The concern has been assembling and manufacturing two models for the past year and these models will be continued with slight changes. They are the four-cylinder, priced at $795, and the six-cylinder, priced at $995.

Under the reorganization C. C. Cummins will be president, H. P. Jeffers, vice-president and F. S. Cummins, secretary and general manager. The plant is located at 402 Mount Vernon Avenue, where it will remain for the time being. It is the plan to manufacture several thousand cars during the coming season and to strengthen the sales organization by securing agents in all of the larger distributing centers.

The Monitor is the result of the work of the Cummins brothers, who were formerly agents in Columbus. They conceived the Monitor several years ago and have been manufacturing a number of the cars.

R. J. Firestone Now Vice-President

AKRON, OHIO, Nov. 9—At the annual meeting of the Firestone Tire & Rubber Co., Nov. 2 R. J. Firestone was elected vice-president. Mr. Firestone has been sales manager for a number of years.

A. G. Partridge, formerly assistant sales manager, was appointed to succeed Mr. Firestone as general sales manager.

F. C. Blanchard becomes manufacturers' sales manager in charge of the company's increasing business among automobile makers.

Braender, of Tire Co., Dies

RUTHERFORD, N. J., Nov. 9—Philip Braender, president of the Braender Rubber and Tire Co., this city, died on Nov. 4 at his home in White Plains in his 68th year.

Mr. Braender was born in Germany in 1849 and at the age of 16 came to America where he entered the real estate and building business in New York City.

In 1911 he entered the rubber business in conjunction with the late Frank McGowan under the style name of Cable Pneumatic Tire Co. and later in 1912 took over this interest under the present name and associated with him was the late G. Strauss, formerly with the Goodyear Rubber Co. in the bicycle tire time.

Mr. Braender was also president of the Braender Building & Construction Co. of New York, a member of the Arion Society of New York and Teutonia Lodge, No. 617, F. & A. M. He leaves a widow and four sons.

VerLinden Elected Olds President

LANSING, MICH., Nov. 13—E. VerLinden, general manager of the Olds Motor Works, has been elected president of that concern. Announcement of VerLinden's election came after a recent meeting of the board of directors of the Olds Motor Works.

VerLinden's early training in production methods was gained with the American Radiator Co. Before joining the Olds organization in 1912, he was a production expert for the Buick company as manager of Plant No. 1.

Prior to his connection with Buick, VerLinden was in business for himself, under the corporate title of the Michigan Auto Parts Co., which was bought by the General Motors Co. in 1909.

Laciar Is Kent General Sales Manager—Stock Being Underwritten

NEW YORK CITY, Nov. 13—R. J. Laciar has been appointed general sales manager of the recently formed Kent Motors Corp. Mr. Laciar made his entry into the automobile field in 1903, at which time he joined the late Capt. La Roche in the marketing of the Darracq car. Later he spent several years popularizing the two-cylinder Buick through the East. He has since been connected with W. E. Metzger in the sale of the E. M. F. car, with the Hupp company as Eastern district manager, and later with W. C. Durant in the Chevrolet organization.

The company, which will build a plant in Bellville, N. J., has a capital consisting of 200,000 shares of the par value of $10 each. Sixty per cent, or 120,000 shares, is held in the treasury. Against this will be issued negotiable trust certificates exchangeable in 3 years for stock.

The Security Transfer and Registrar Co., 66 Broadway, this city, has been designated as the depository and transfer agent of the company. The stock has been underwritten and is to be listed, it is stated, on the New York Curb market.

McCulla in Overland Engineering Dept.

DETROIT, Nov. 12—William R. McCulla has joined the engineering forces of the Willys-Overland Co. Mr. McCulla was formerly the aircraft motor engineer for the Packard Motor Car Co.

New Plant for Saxon Co.

To Build on 40-Acre Plot—First Unit of 500,000 Sq. Ft. Floorspace

DETROIT, MICH., Nov. 12—The Saxon Motor Car Corp. is commencing the erection of a new plant on 40 acres of land recently purchased by them. The first unit will be 240 by 1262 ft. and will have 500,000 sq. ft. of floorspace, and will house several departments so grouped that a car will move steadily forward from one end of the building to the other for assembly construction.

Progressive manufacturing and assembling will be employed in every department possible. Incoming material will be moved by traveling cranes and elevators to the stockrooms, and a system of conveyors is planned by which stock will be carried to the different manufacturing departments. The first unit will be completed May 1, and the remainder of the buildings June 1, 1917.

Empire Tire To Be Refinanced

TRENTON, N. J., Nov. 14—Increased business and expansion has forced one more company to join the long list of those to be refinanced this year. The Empire Rubber & Tire Co., this city, has about completed negotiations for reorganization and refinancing. The details of the plans of refinancing will be announced in the near future as soon as completed. At present the plans for the underwriting of the new stock are being worked out by Andrews & Co., New York. General C. E. Murray will continue as the active head of the company.

The Empire company was organized in 1913 with a capital stock of $500,000 common and $500,000 7 per cent cumulative preferred, with $500,000 common and $428,720 preferred outstanding.

Hammers Is Hackett Consulting Engineer

DETROIT, MICH., Nov. 11—M. J. Hammers has been retained as consulting engineer for the Hackett Motor Car Co., and has been appointed as a non-resident director of the company.

Lascaris Re-elected Salon Head

NEW YORK CITY, Nov. 13—At its recent meeting the Automobile Salon, Inc., which will conduct the Automobile Salon on Jan. 2 to 10 at the Astor, this city, re-elected Emanuel Lascaris president and T. E. Adams vice-president. Robert Schuette was elected secretary-treasurer, succeeding the late Stefan Kjeldsen, and J. R. Eustis was appointed manager of the salon.

N. A. C. C. Opposes Scare Ads.

Eighty Members Go on Record as Against It—Committee for Improvement

NEW YORK CITY, Nov. 13—With the object of eliminating what it terms "scare" advertising, eighty members of the National Automobile Chamber of Commerce at its last meeting recorded themselves as being opposed to advertising which can be classed under this head. This opposition is directed against not only concerns connected with the automobile industry, but against advertising in general which can be characterized under the scare heading.

Exactly what is meant by scare advertising might be made clear from the following extract bearing on the subject. "We may expect to see pictures of people dying in restaurants because they ate the wrong brand of bacon; of people mangled at the bottom of elevator shafts because they rode in an elevator using the wrong safety device; of children being rescued from fires because the wrong kind of window panes were used in the building; of passengers being carried under the ocean waves because they traveled on the wrong steamship line," etc., etc.

The N. A. C. C. has at present a committee working for a betterment of advertising along this line. This committee is expected to accomplish as much as possible by co-operation not only with vehicle makers, but also with those manufacturing parts and accessories. The question of scare advertising has already been taken up with certain companies, and it is expected that there will be an elimination of such as the result of this work.

The reason for the N. A. C. C. taking up this matter is that members of the chamber hold the view that scare copy is negative rather than affirmative in its effect, and that some more positive and constructive form of advertising could be used.

A. O. Smith Corp. Incorporated

ALBANY, N. Y., Nov. 14—The A. O. Smith Corp., as a result of the recent refinancing, has been incorporated in this state with 130,000 shares, of which 100,000 shares are without par value. It will carry on business with $3,500,000. The directors are L. H. Gunther, S. B. Howard and A. W. Britton.

Dodge Suit Against Ford Postponed

DETROIT, Nov. 15—A continuance of 1 week, by consent of opposing counsel, was granted in the injunction proceedings started by Dodge Bros. to restrain Henry Ford from extending the Ford plant and to compel a further distribution of profits to Ford stockholders.

"The preliminary taking of evidence will not be finished in the coming week," said Attorney E. G. Stevenson for Dodge Bros., "but we expect it will have reached a point where we can come into court and agree upon the fixing of the day certain for the commencement of the trial."

The plaintiffs state that they expect to present evidence to show that the expansion planned by the Ford head jeopardizes the monetary interests of the minority stockholders.

$200,000,000 Offered

Henry Ford on the witness stand today admitted the offer of $200,000,000 was recently made to him for his 58 per cent of the shares of Ford stock. This offer he rejected and stated that his company made $3,600,000 in August and September, 1916, following the price decrease.

Lozier Bros. Co. Formed—$10,000,000 Capital

CLEVELAND, Nov. 14—Harry A. Lozier, former president of the Lozier Motor Car Co., and who recently retired as president of the H. A. Lozier Co., this city, has launched a new company, the Lozier Bros. Co., capitalized at $10,000,000. New York and Philadelphia capital is stated to be behind the company. Only 25 per cent of the capital is to be issued at present, the balance being reserved for subsequent disposal in expanding the business. The incorporators are F. R. Hansell of Philadelphia and G. H. B. Martin and S. C. Zymour of Camden, N. J.

S. R. B. Creditors Ask for Sale

PHILADELPHIA, PA., Nov. 9—A committee consisting of 95 per cent of the creditors of the Standard Roller Bearing Co., which went into the hands of a receiver in 1913, has asked the Federal Court for an order to sell the property to pay the creditors. The sale has been objected to by some stockholders, who maintain that only the disposal of merchandise is necessary to meet all claims. Judge Thompson has decided to permit counsel to get together and draw a decree providing for a sale that will satisfy all claims and submit it to the court for approval.

Burgess Resigns from Dorris

ST. LOUIS, MO., Nov. 9—W. L. Burgess, has resigned as sales manager of the Dorris Motor Car Co., St. Louis, and is now manager of sales of the Efficiency Oil Corp., St. Louis.

Bankers in Control of Hess-Bright

Vanderlip One of Group—Conrad Patent Control Remains with Hess-Bright

PHILADELPHIA, PA., Nov. 14—The Hess-Bright Mfg. Co., manufacturer of ball bearings in this city makes the following statement with regard to the purchase of controlling interests in its company by a group of financial men who also own a substantial interest in the S. K. F. Ball Bearing Co., Hartford, Conn. The company states that controlling interest in the shares of the Hess-Bright Mfg. Co. has been secured by a group of bankers including Frank A. Vanderlip, National City Bank, New York, and Phillip W. Henry, Thatcher M. Brown, and Franklyn B. Kirkbride, of New York, and Marcus Wallenberg of Stockholm, Sweden.

The Hess-Bright company and the S. K. F. company will be operated quite independently of each other. The manufacturing facilities of Hess-Bright will be increased materially. B. D. Gray, recently elected president, retains his former stock holdings and will continue to manage the business as president. F. E. Bright, one of the organizers of the company, has retired from active participation but remains as chairman of the board of directors. The remainder of the organization continues as heretofore, excepting the board of directors, which follows:

Chairman of board, F. E. Bright; President, B. D. Gray; Willard Parker Butler, New York; Arthur V. Morton, Philadelphia; Paul von Gontard, managing director of the Deutsche Waffen- und Munitions Fabriken, Berlin, Germany.

Last week THE AUTOMOBILE mentioned that control of the Conrad patent royalties would pass from the Hess-Bright Co. This is not the case, as complete control of the Conrad patents will continue with the Hess-Bright Mfg. Co. as heretofore.

Edwards Joins Automatic Carbureter

CHICAGO, Nov. 14—F. E. Edwards of Chicago, one of the most widely known men in American motor-racing circles, has joined the Automatic Carbureter Co., Chicago, as efficiency engineer. His chief work at present will be the introduction of the new Church fuel feed. Edwards has been chairman of the technical committee of the American Automobile Assn. and its chief technical representative for a number of years, and has supervised the majority of the speed and economy tests during that time.

WintherMotorTruck Co. Formed

Capital to Be $330,000—Factory to Be Built at Kenosha in Spring

KENOSHA, WIS., Nov. 11—M. P. Winther, who has been prominent in the development of the Jeffery Quad and for many years was associated with the Thomas B. Jeffery Co., Kenosha, has organized the Winther Motor Truck Co., with an authorized capital stock of $330,000, and is making final arrangements for the construction and equipment of a large factory in this city. A tract of 4 acres just west of Kenosha was purchased yesterday, and it is hoped that by the middle of April work on buildings will have progressed sufficiently to make production possible. Further details concerning the personnel of the Winther organization, the extent of its shops, and the product, are not available at this time, but will be made public in due time.

Watts Joins Republic Rubber

YOUNGSTOWN, OHIO, Nov. 9—L. A. Watts has been appointed purchasing agent of the Republic Rubber Co., this city. Other changes include the addition of James Buckley, who succeeds Neal Mahan as general foreman of the pneumatic tire and tube departments. Harry Davenport will be succeeded as foreman of the truck tire department by Thomas Wilson.

Eaton Torbensen Axle Manager

CLEVELAND, Nov. 13—J. O. Eaton, treasurer of the Torbensen Axle Co., Cleveland, was elected general manager of the company at a directors' meeting held recently.

Dudley Federal Truck Advertising Mgr.

DETROIT, Nov. 12—L. B. Dudley has been made the advertising manager of the Federal Motor Truck Co. He succeeds G. W. Cushing, who recently resigned to join the advertising staff of the Hudson Motor Car Co. Mr. Dudley was formerly connected with the Campbell-Ewald Co., advertising agent.

New Acme Truck Worm Axle

DETROIT, MICH., Nov. 10—The Acme Motor Truck Co., this city, is now producing a worm-driven truck axle incorporating, as its principal feature, the M. & S. worm differential. Another feature of the axle is that the brakes, of special design, have a full contact for the entire circumference excepting the small space occupied by the actuating cams.

It is built in a size for 2½- or 3-ton trucks, the standard reduction for this size being 7¾ to 1. The axle is a one-piece steel casting, with the worm gear carried in a separate carrier secured by eight bolts and having the small worm housing and axle bowl cover integral with it. The axle is of the semi-floating type, running on ball bearings throughout. The worm is of the straight type.

Glide to Make Its Own Motors

PEORIA, ILL., Nov. 13—In line with the general policy of the Bartholomew Co., maker of the Glide car, to concentrate the manufacture of its entire car in its local plant, is the announcement of a large addition to its plant for the purpose of building its own engines. The company is at present using a stock motor.

National Carbon to Add

CLEVELAND, OHIO, Nov. 13—The National Carbon Co., this city, maker of batteries, will soon erect new factory buildings costing $1,000,000. The company has just bought a parcel of land across Berea Road from the present carbon plant. This 63 1-3-acre tract has a frontage of 3368 ft.

Cornell Is Cole Asst. Sales Mgr.

INDIANAPOLIS, IND., Nov. 11—F. A. Cornell, formerly in charge of Willys-Overland service department and since then in charge of the heater department of the Perfection Spring Co., has been made assistant sales manager of the Cole Motor Car Co., in charge of the service department.

Graves Joins Russel Axle

DETROIT, MICH., Nov. 11—H. S. Graves has been appointed sales engineer of the Russel Motor Axle Co., North Detroit, Mich. Mr. Graves was formerly connected with the General Motors Co. as engineer. He has been connected with the automobile industry for the past 11 years.

Baker Resigns from G. V.

BOSTON, MASS., Nov. 13—Day Baker has resigned from the electric vehicle business of the General Vehicle Co. in New England.

Wiltrout Joins Crow-Elkhart

ELKHART, IND., Nov. 13—R. S. Wiltrout has been made efficiency manager of the Crow-Elkhart Motor Co., Elkhart, Ind. He was formerly with the Stewart-Warner Speedometer Corp. and recently has been manager for the John W. Blackledge Mfg. Co.

Papers for S. A. E. Meeting

Aeroplane and Farm Tractor Engines Will Be Covered——Many Others Promised

NEW YORK CITY, Nov. 13—The technical papers to be presented at the 1-day professional session on Jan. 11 of the Winter Meeting of the Society of Automobile Engineers will be representative of the enlarged activities of the society. Some of the papers will relate to automobile engineering, but in addition subjects of interest to aeroplane, tractor and marine engineers will be presented. The papers committee, of which K. W. Zimmerschied is chairman, is making the arrangements.

Captain V. E. Clark, U. S. A., will present a paper an aeroplanes with special relation to engines. This paper will deal also with the experiences of the army aviators on the Mexican border and suggest improvements in construction. It is also hoped that a detailed description will be given of a foreign aeroplane engine, which has recently been produced commercially in this country. A well-known engineer will discuss the design of engines for farm tractors. A paper will probably be read on motor trucks, with reference particularly to the proposed military specifications now being considered by the truck standards division of the S. A. E. standards committee and a specially appointed board of the War Department.

Tentative plans have been made to have experts contribute papers on passenger car spring-suspension, electrical equipment of gasoline cars, high-speed automobile engines, dynamics of the automobile and crankshaft balancing. It will thus be seen that the papers are of sufficient variety to attract every member of the Society. The authors will give brief digests of their papers, thus allowing time for lengthy and adequate discussion of the more important ones.

S. A. E. Dinner and Theater Party Tickets Scarce

NEW YORK CITY, Nov. 16—That the annual banquet of the Society of Automobile Engineers on Jan. 11 at the Hotel Biltmore will be a banner one in point of attendance is assured by the fact that to date 460 tickets have been sold. The capacity is 750.

Every seat, numbering 762 has been taken for the special performance of Ziegfeld's Midnight Follies, which comes as a climax to the dinner. The demand for these seats has been so large that thirty applications so far have been returned.

Toledo Plants Are Rushed

Factories Breaking All Production Records and Financial Outlook Is Promising

TOLEDO, OHIO, Nov. 13—Toledo automobile and parts makers are rushed to capacity. Each company is building or planning to care for increased demand. The chief difficulties of the plants are lack of skilled workmen and insufficient space. Everywhere the companies tell of remarkable prosperity and an extremely good financial future outlook.

The Electric Auto-Lite Co. has enjoyed a great expansion. The company employs 2200 people and occupies 422,000 sq. ft. of floorspace, and has four buildings in the plant, including a new one recently finished and utilized. One structure is used for heavy machine work and assembly, a second for stock rooms, receiving and shipping, mail order and repair work, and on one floor has 500 girls engaged in winding field coils and armatures. A third building is occupied as a factory for making lamps, horns and starting switches, and the fourth serves as the office, drafting and experimental structure. The new building is four-stories high and constructed entirely of steel, glass and brick.

The concern did $6,000,000 business in 1915 and to date has shipped $10,000,000 worth for 1916, manufacturing 1400 starters a day now as compared with 800 in the year preceding. Numerous mechanical improvements have been installed to increase facilities for production, and include electric ovens, cable conveyors, twenty automatic machines, automatic punch presses, milling machines and eighty Potter & Johnson machines.

Milburn's Big Increase

At the Milburn Wagon Works 900 men are employed, as compared to 600 men at the same time in 1915. The company is making 1500 cars this year as against 1000 in 1915. It has purchased the plant of the Toledo Bending Co. and converted it into plant No. 2 of the Milburn factories, adding 128,732 sq. ft. to the 514,931 sq. ft. already occupied. It is planned to use plant No. 1 for the manufacture of closed cars and bodies, and plant No. 2 for making custom-made bodies and to care for light delivery business.

The concern has recently developed the electric taxicab business and plans to engage in that particular branch of the industry with special effort. Body work has increased 100 per cent, and from present indications will grow an additional 100 per cent during the coming year.

The Ohio Electric Vehicle Co. states that October was one of the most successful months in the company's career. Business for the year has increased more than 100 per cent. The concern manufactured 650 cars to date in 1916, as compared with 300 cars in 1915, and have doubled the number of salesmen on the road, doubled their national advertising and increased the number of men employed by 40 per cent. At present they employ 250 men, but would take on 300 men if they could find the skilled aluminum workers they require. From present prospects they anticipate an increase of 1000 per cent in business for the coming year.

Haynes to Add 600,000 Sq. Ft.

KOKOMO, IND., Nov. 13—The board of directors of the Haynes Automobile Co. last week authorized A. G. Sieberling, general manager, to prepare plans for a new building and to buy machinery for a capacity of 100 cars daily. It was announced that contracts will be let for buildings which will have a capacity of three times the number of cars made at present. The new buildings will have about 600,000 sq. ft. of floor space, which will be added to 350,000 sq. ft. now in operation in the company's plant.

Standard Tractor to Move

ST. PAUL, Nov. 11—The Standard Tractor Co., St. Paul and Wilimar, Minn., will move to the old prison at Stillwater, Minn. The company has $500,000 capital. It makes tractor engine plows and other farm machinery.

Briscoe Plants for K. C. and S. F.

SAN FRANCISCO, CAL., Nov. 11—The Briscoe Motor Corp., Detroit, Mich., has completed plans to build an assembling plant in this city and Kansas City, Mo. The local plant will be capable of turning out from 10,000 to 20,000 cars a season. The Kansas City plant will cost $300,000.

More Room for Mayo-Skinner

CHICAGO, Nov. 13—The Mayo-Skinner Mfg. Co. has moved into enlarged quarters at 2115 Elston avenue. The company will enlarge its line in the near future.

S. G. V. Creditors to Meet

READING, PA., Nov. 11—The creditors of the S. G. V. Co. of Delaware, which formerly operated its automobile plant here, will meet in the near future to distribute $85,000 in the hands of a receiver.

To Build Monarch in Hyattsville

Carter Brothers Co. Secures Exclusive Rights To Build Eight and Twelve

HYATTSVILLE, MD., Nov. 13—Monarch cars will be manufactured in this city as soon as all the machinery and materials arrive here. The Carter Brothers Co., this city, has secured the exclusive rights of the Monarch Motor Car Co., Detroit, and will build both Monarch models, an eight and a twelve.

In addition to the above standard models a new design of light car will be added to be known as the Monarch Midget.

The business of the Monarch company will be continued under the Monarch Motor Car Co., a subsidiary organization of the Carter Brothers Co.

Holihan Completes New Plant

DETROIT, Nov. 12—The Holihan Mfg. Co. has just completed its new plant on the 3½ acres of land they recently purchased. The main building is 80 by 400 ft. of the latest construction and includes steel and glass windows and a monitor roof. In addition a steel storage structure 65 by 45 ft., and a shipping shed 65 by 45 ft. with floors raised to car level are in process of completion.

The company has made ample allowance for future expansion and the present plant will cover about 50,000 sq. ft. of floor space.

At a special meeting of the stockholders, the capital stock was increased to $135,000, and the board of directors was increased by the election of H. J. Moir of Donaldson & Moir, and S. E. Ferris of H. W. Noble & Co.

Palmer-Moore To Quadruple Capacity

SYRACUSE, N. Y., Nov. 13—The Palmer-Moore Co. has increased its capital stock from $200,000 to $300,000. The additional capital will be used to quadruple the output of the plant, bringing the production up to above 600 trucks during the next year.

Elgin Motor Corp. to Add

CHICAGO, ILL., Nov. 13—The Elgin Motor Car Corp., this city will erect several additions to its factory to take care of increased business. This increased space will enable the company to build from 20,000 to 25,000 cars after the original year's allotment of 7500 is completed. Another building is now in process of construction and will permit the building of thirty cars a day.

Build Ams-Sterling at Amston

C. M. Ams Becomes President —Headquarters in Bridgeport —Car Design Improved

New York City, Nov. 13—Headquarters of the Sterling Automobile Mfg. Co., Inc., have been moved from this city to Bridgeport, Conn., Charles M. Ams having become president of the concern. Ams-Sterling cars will be built in a factory at Amston, Conn., in one chassis on which will be mounted roadster, five-passenger touring car and ½-ton delivery bodies.

Car at National Shows

The Sterling company will exhibit a car and a chassis at the national shows. Present specifications, which may be slightly changed later, differ from last year's model in several particulars, the general tendency being toward larger and better dimensions and equipment. Wheelbase has been lengthened from 102 to 110 in. The engine will continue as a four-cylinder L-head type, but will be 3⅛ by 4½ instead of 2⅞ by 4 in. This power plant has a removable head and its power output is 28 hp. at 2200 r.p.m. High efficiency and economy are the aims of its designers. Oiling is combination pump and splash with sight feed on cowlboard. Cooling continues thermo-syphon with a honeycomb radiator with polished German silver shell. Timing gears are helical and valves are large diameter with moderate lift.

A Stromberg model M carbureter replaces the make used last year and ignition is now by Bosch high-tension magneto instead of optional. Bosch starting and lighting is used with Willard 12-volt battery.

Dry-Plate Clutch Used

A Borg & Beck dry-plate clutch replaces the cone type previously used. The three-speed-and-reverse selective gearbox is continued. A semi-floating rear axle supplants the three-quarter design, and semi-elliptic springs replace cantilevers. Hotchkiss drive is continued. Control is still left, steering being of the irreversible split nut type, a 17-in. corrugated walnut wheel being used. Gasoline tank is in the cowl with filler cap and gage in the cowlboard. Tires are 30 by 3½, the same as last year. Wheels are hickory with twelve spokes and fitted with demountable rims.

Equipment includes two-piece windshield, double-bulb headlamps, tail and dash lights, Warner speedometer driven from the propeller shaft, one-man Jiffy top and dust boot, tools, etc.

Bodies are low, rakish streamline types with comfortable seats and plenty of leg-room. They are upholstered in black and painted Sterling blue black. Although price has not yet been definitely determined, it will probably be between $700 and $725.

Abbott Downing Trucks on Market

Boston, Mass., Nov. 11—The Abbott Downing Co., Concord, N. H., one of the pioneer wagon builders in this country, which recently entered the truck making field, has leased salesrooms in Boston at 84 Brookline Avenue, in charge of F. S. Davis. The company is making two trucks of 1 and 2-ton capacities that will sell at medium prices.

The company will give special attention to truck bodies because of its facilities at its big plant at Concord, N. H. It will continue in the wagon making business also. Until the building is fully completed on Brookline Avenue where its sales and service station will be conducted, Mr. Davis will make his headquarters at 394 Atlantic Avenue.

Canadian Chevrolet Sells 8000 Cars

Oshawa, Ont., Nov. 11—The Chevrolet Motor Co. of Canada with headquarters at Oshawa, Ont., which has been manufacturing cars for a year, has sold 8000 cars to Canadians and has under course of construction large extensions to its present plant. Three new buildings are in course of construction which will give a total extra floorspace of 277,075 sq. ft. Part of this extra space will be used for storage and part for service but the larger part utilized in increasing its manufacturing facilities.

Wants to Represent Tire in S. A.

New York City, Nov. 13—Walter E. Haumann, manager in Buenos Aires for Prowodnik tires, made in Riga, Russia, is in this city looking for representation of some American tire in Argentina. Mr. Haumann was manager of the Prowodnik interests from the start of the Buenos Aires branch until it was closed due to war conditions a few months ago. Previous to his South American experience he spent 4 years in Portuguese East Africa in export and import work.

Fisher Body Sales Record

Detroit, Nov. 14—A new high record was established by the Fisher Body Corp. in October when the sales amounted to $1,470,000, compared with $773,000 in October, 1915, an increase of 90.12 per cent. For the 8 months ended Oct. 31 last the sales increased 79.74 per cent.

Chicago Warehouse for Marathon Tire

Cuyahoga Falls, Ohio, Nov. 13—The Marathon Tire & Rubber Co. will open a warehouse in Chicago at 1458 South Michigan Avenue. It will be under the management of H. F. Smith.

Pilot's One-Model Program

Touring Car and Roadster at $1150 Each—Production To Be Doubled

Richmond, Ind., Nov. 13—The Pilot Motor Car Co. of this city will confine its 1917 manufacturing efforts to a single car model known as 6-45, which will list as a touring car and roadster at $1150. The two models 6-55 and 6-75, which the concern has been manufacturing, have been discontinued. Increased production is to be carried out on the one model, and factory additions are now nearly completed, which should double the production of last year. In addition to the 6-45 being produced as a five-passenger car with a double cowl, it will also be built as a four-passenger roadster type with divided front seats and access to the rear seat via the space between the front ones.

In this one chassis the motor is a six-cylinder block type, 3⅛ by 5 with valves on one side. The cylinders are cast integrally with the upper half of the crankcase and the camshaft, water pump, and magneto shaft are driven by helical gears. Delco ignition, lighting and starting is used with the Bendix drive for the starting system. Other equipment includes Stewart vacuum gasoline system and Gould battery. The clutch is a dry-plate type, and the gearset, a unit with the motor, is a three-speed design with nickel steel gears. The tubular propeller shaft carries two inclosed universal joints. The floating axle uses spiral bevel reduction. Steering is irreversible worm and sector type. Cantilever rear springs are used.

The equipment includes a motor-driven horn, Stewart speedometer, one-man top, single tire carrier, and demountable rims.

Kerosene Motors Co. Formed

Peoria, Ill., Nov. 9—The Kerosene Motors Co. with a capital of $100,000 has been formed in this city to manufacture kerosene motors and accessories. The organizers are George McFarland, president of the Peoria Tractor Co., E. M. Smith and F. H. Bush. The motor is similar to that used in the Peoria tractors. Manufacturing is expected to start in about 30 days, the company planning to make the entire new motor and its parts. The company recently made a test trip of 8000 miles.

King Tire Opens New Plant

Detroit, Nov. 12—The King Tubeless Tire Co. will open its new plant at Barberton, Ohio, this week.

Brunswick M. C. Co. Formed

To Assemble Car Selling at $1,950—Capitalized at $500,000

NEWARK, N. J., Nov. 13—The Brunswick Motor Car Co. has been formed with a capitalization of $500,000 to produce an assembled automobile selling at $1,950, f.o.b. Newark. A four-cylinder Wisconsin engine, 4¾ by 5½, with a Rayfield carbureter is used. Other features are: Fedders radiator, Bosch magneto, Westinghouse starting and lighting, Brown-Lipe gearset, Timken axles and Parish & Bingham frame. It also uses Gemmer steering gear, Stewart vacuum feed and Silvertown cord tires. Drive is Hotchkiss type.

The body is of a high quality job, all rear compartment woodwork being of mahogany, as is the instrument board. There are also five mahogany cabinets in the rear compartment, containing a set of Thermos bottles, sandwich tins, and room for other articles. Each cabinet has a Yale lock. Two Waltham clocks are furnished, one on the instrument board and one in front of the rear compartment.

Russel Smith is president of the company, Everett Cadmus is vice-president, J. T. Bunt is secretary, and A. V. Weeks is treasurer. The company is temporarily using a plant of 15,000 sq. ft. floor-space, but a new plant will later be established along the Pennsylvania Railroad tracks outside of Newark. From 500 to 1000 cars will be produced during the coming year.

Aniser Becomes Mechanical Belt

ST. JOSEPH, MO., Nov. 13—The Aniser Mfg. Co. has changed its corporate name to Mechanical Belt Co. and is marketing Crowe fan belts exclusively. L. D. W. Van Vliet is president, other officers being, secretary and treasurer, H. D. Gilbert; sales manager, O. G. Young, Jr.; directors, J. D. Richardson, J. E. Dolman and the officers.

Firestone Gives $1,000,000 for Welfare

AKRON, OHIO, Nov. 13—The Firestone Tire & Rubber Co., this city, has voted to give $1,000,000 for an employees' welfare and insurance fund. Two weeks ago the company opened its new club house, said to have cost over $300,000.

$1,000,000 Plant for Victor

PHILADELPHIA, Nov. 14—The Victor Motor Co., this city, capitalized at $2,000,000, will build a $1,000,000 plant at Grubbs Landing, near Claymont, Del., for the manufacture of the Victor Four, a moderate-priced car. The company recently bought 12 acres of land there for building purposes. It has also leased a group of eight factory buildings at Jenkintown, and will commence operations there in a limited way. One thousand men will be given employment in the temporary plant. The employees in the whole plant will number 2000.

Iowa Companies Merge

FORT MADISON, IOWA, Nov. 13—At a special meeting the stockholders of the Perfection Tire & Rubber Co., Fort Madison, Iowa, it was voted unanimously to consolidate the Perfection Tire & Rubber Co., the Perfection Tire & Rubber Co., Ltd., and the Champion Auto & Equipment Co. About 130 stockholders and officers were in attendance.

Goldman to Build Trucks

CHICAGO, ILL., Nov. 13—Eugene Goldman, Chicago Republic truck dealer, is severing his connection with that company and has organized his own company to build trucks. Complete announcement and specifications will be given later.

Pullmore Motor Truck Co. Formed

NEW CASTLE, OHIO, Nov. 2—The Pullmore Motor Truck Co. has been organized in this city with a capital of $600,000, the concern having purchased a site on the Gibson farm, along the Butler Avenue Road.

Advertisement Errors

A typographical error appeared last week in the advertisement of the U. S. Ball Bearing Co. in THE AUTOMOBILE. The advertisement stated: "A leading manufacturer of worm gear units in England advised against the use of annular bearings to carry worm loads." This was in error. The copy should have read: "A leading manufacturer of worm gears in England advises against the use of roller bearings to carry worm loads and recommends the use of annular bearings to carry worm loads."

A clerical error in the advertisement of the Golden, Belknap & Swartz Co. appearing in THE AUTOMOBILE for Oct. 19 made it appear that the cylinders of the G. B. & S. engine have a bore of 3¾ in. and a stroke of 4¾ in. The dimensions should have been 3¾ in. bore and 4¼ in. stroke.

Fisher Body Buys Regal Unit

DETROIT, MICH., Nov. 13—The impression given in a story last week that the whole plant of the Regal Motor Car Co. was sold to the Fisher Body Co. was due to an error, as the Regal company sold only one of its units to that company.

$2,000,000 Plant for Cadillac

Co. Plans To Increase Working Force from Present 8000 to 12,000

DETROIT, MICH., Nov. 14—The Cadillac Motor Car Co. has purchased a 40-acre site formerly owned by the American Car & Foundry Co. and will erect a new factory for the construction of Cadillac cars. The projected plant, upon completion, will entail an investment in buildings and machinery of approximately $2,000,000. The company plans to employ about 12,000 men in the new factory. At present the company has 8000 employees.

Goodyear to Make Own Fabric

HARTFORD, CONN., Nov. 11—The Goodyear Cotton Mills, of Killingly, Conn., has been incorporated with $5,000,000 capital, to engage in general textile manufacturing. The incorporators are Francis Seiberling, Fred Miller and Harold Hutchins. This concern is practically a subsidiary of the Goodyear Tire & Rubber Co., Akron, and will manufacture tire fabrics for that concern.

Erickson Building Front-Drive Truck

WARREN, PA., Nov. 11—C. A. Erickson, formerly with the Scripps-Booth Co., Detroit, Mich., has arrived in this city and is perfecting two models of a front-drive delivery truck in the plant of the Jacobson Machine Mfg. Co. The light delivery truck which Mr. Erickson is bringing out will carry from 1000 to 1500 lb.

Harroun to Complete Factory by Spring

DETROIT, MICH., Nov. 11—The Harroun Motor Corp. is hastening every detail in the endeavor to complete their new factory by the early spring of 1917, so that next May will witness the new structure, with 300,000 sq. ft. of floor space, complete and ready to produce 2000 motor cars a month.

To Make Borland Wheel

ST. PAUL, Nov. 11—A company is to be incorporated to make the J. A. Borland wheel with solid rubber tire invented by Borland, recently of Cincinnati. Hadley Summers is to be president and E. C. Piersal, Dodge Center, Minn., is to be treasurer. R. M. Lampman is secretary and C. F. Updike vice-president under present plans.

Youngstown Co. to Add

YOUNGSTOWN, OHIO, Nov. 9—Plant extensions that will involve an expenditure of about $4,000,000 will be made by the Youngstown Sheet & Tube Co., this city.

Grossman Reincorporates

Forms Corporation with $320,000 Capital All Paid in To Take Care of Expansion

New York City, Nov. 13—The Emil Grossman Mfg. Corp. with a capital of $320,000 has been formed as the result of a reorganization of the company, which is part of the management's plan for the enlargement of the business. The activities of the company will be concentrated on the production of Red Head spark plugs, Ever Good bumpers and Ever Good mirrors. The manufacturing facilities in the Bush Terminal No. 20, will be enlarged. The company has leased building No. 95, Bush Terminal, for the exclusive rust proofing process which will be applied to all metal goods. The producing capacity in the grinding, polishing, nickel-plating and black enameling departments will be trebled.

The capital stock is divided into $150,000 first preferred; $160,000 second preferred; and $10,000 shares of common stock of no par value. The entire capital has been paid in. The capital of the old company consisted of $250,000 common and $100,000 preferred. This was all bought back by Emil Grossman, president and general manager.

O'Connor Back from Australia

Detroit, Mich., Nov. 14—N. E. O'Connor of the service department of the Maxwell Motor Co. has returned to Detroit following a 3-months' trip in Australia and New Zealand.

M. & A. M. Adds Six Members

New York City, Nov. 13—The Motor and Accessory Manufacturers has added six new concerns to membership, bringing the total membership of the association to 260. Those admitted are: Walker Mfg. Co., Racine, Wis., accessories; Becker Brothers, Chicago, Ill., brushes for starting motors, lighting generators and magnetos. Bay State Pump Co., Boston, Mass., engine driven tire pumps and piston packings. Universal Motor Products Co., Indianapolis, Ind., tops. Ericsson Mfg. Co., Buffalo, N. Y., ignition apparatus, Berling magnetos. Craftsman Motor Corp., Chicago, Ill., detachable wire wheels and heaters.

Dazey Joins Chalmers Co.

Detroit, Mich., Nov. 14—Roy Dazey has joined the Chalmers Motor Co. to take charge of the department that publishes the various house organs. Mr. Dazey was formerly connected with the Packard Motor Car Co. in the sales department.

Wilson Tire Reorganization Planned

Springfield, Ill., Nov. 10—A reorganization of the Wilson Tire and Rubber Co., this city, is now in process. W. W. Gardner, treasurer of the company, has resigned and it is stated that E. W. Wilson, president and chief promoter of the company, will be succeeded by a new president at the next meeting of the board of directors.

Increased Capitals

New York City, Nov. 10—Brewster & Co., Long Island City, has increased its capital from $2,000,000 to $2,500,000 to provide funds for the manufacture of a chassis for its automobiles, formerly imported from England and France.

Springfield, Ohio, Nov. 11—The Kelly-Springfield Motor Truck Co.; increase of capital from $3,014,000 to $6,000,000.

Cleveland, Ohio, Nov. 11—The Hall Motor Car Co.; increase of capital from $1,000,000 to $2,000,000.

Dayton, Ohio, Nov. 13—The Acme Carbureter & Mfg. Co.; increase of capital from $10,000 to $15,000.

Daily Market Reports for the Past Week

Material	Mon.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	65	.65	.65	.65	.65	.65	...
Autimony, lb.	.13	.13	.13	.13	.13	.13	...
Beams and Channels, 100 lb.	2.96	2.96	2.96	2.96	2.96	2.96	...
Bessemer Steel, ton	50.00	50.00	50.00	50.00	50.00	50.00	...
Copper, Elec., lb.	.30	.30	.30	.30	.33	.33	+ .03
Copper, Lake, lb.	.30	.30	.30	.30	.33	.33	+ .03
Cottonseed Oil, bbl.	12.09	12.39	12.45	12.70	12.60	12.67	+ .58
Fish Oil, Menhaden, Brown, gal	60	.60	.60	.62	.62	.62	+ .02
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.25	1.25	1.25	1.40	1.40	1.30	+ .05
Lead, 100 lb.	7.02½	7.02½	7.02½	7.02½	7.02½	7.02½	...
Linseed Oil, gal.	.90	.90	.93	.96	.96	.96	+ .06
Open-Hearth Steel, ton	50.00	50.00	50.00	50.00	50.00	50.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.82	.82	.82	.82	.82	.82	...
Rubber, Ceylon, First Latex, lb.	.66	.68	.68	.67½	.67	.66	...
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	42.37½	42.85	43.00	43.37½	43.37½	43.87½	+1.50
Tire Scrap, lb.	06⅛	.06⅛	.06⅛	.06⅛	.06⅛	.06⅛	...

Copper at 33 Cents Per Lb.

Highest It Has Been Since 1864—Steel Expected To Go Up

New York City, Nov. 13—Copper featured this week's market activities with a rise of 3 cents a lb. to 33 cents. Tin rose $1.50 per 100 lb. to $43.87½. Fish oil rose 2 cents a gal. and lard oil 5 cents a gal. Linseed oil rose 6 cents a gal. to 96.

The enormous demand for copper is not yet satisfied and sellers predict 35 cents a lb. A glance over the price range since 1860 shows the high range that copper has reached. In 1860 this metal sold high at 24 cents a lb., and in 1864 reached 55 cents, the highest that has ever been paid for it. In 1894 it dropped as low as 9 cents a lb., the lowest price ever paid. Last year this time it sold as low as 13 cents and as high as 24 cents.

Though no increase took place this week in the steel market there is an upward tendency seen in quotations. The greatest activity since the present movement in the steel trade started is now here. Prices are showing increasing signs of moving toward even higher levels, despite the sharp advances already made. Foreign countries are inquiring for the metal, and domestic consumers also are taking whatever quantities the manufacturers are willing to book.

The market for crude rubber, particularly fine Para, is firm. Owing to an unusual drouth in the upper Amazon districts it has been impossible to get the crop down to Para and Manaos in normal amounts. Quotations are now 82 cents a lb. as against 73 a month ago.

Leak-Proof Business

St. Louis, Mo., Nov. 13—L. A. Safford, vice-president of the McQuay-Norris Mfg. Co., maker of Leak-Proof piston rings, says that business reports made at the meeting of the company's salesmen last week indicate a greatly increased business for the coming year. The reports, especially from Texas and the South, were the best ever received and indicated that the jobbers in that territory were set for their greatest year's business in 1917.

Longuet Buys Accessories for S. A.

New York City, Nov. 8—C. Longuet of the firm of Longuet & Co., Buenos Aires, Argentina, is spending some time in U. S. A. making purchases of automobile accessory lines for Argentina.

Mr. Longuet is making a rather complete study of various accessories that should be suitable for his field. He is taking the careful course of submitting samples to his firm before placing orders. In this way he is making certain that the lines of accessories are suitable. Two years ago Mr. Longuet spent some months in this country making purchases of automobile accessories and hardware merchandise.

Offer to Standard Welding Shareholders

CLEVELAND, Nov. 12—Shareholders of the Standard Welding Co. have received an offer from Borton & Borton, investment bankers, to purchase the property of the company at a price that will net them between $244 and $245 a share. The assent of 90 per cent of the total outstanding stock is necessary to transact the deal.

Dividends Declared

Maxwell Motor Co.; quarterly of 2½ per cent on common, payable Jan. 2 to stock of record Dec. 11.

Texas Co., regular quarterly 2½ per cent, payable Jan. 1.

Pratt & Whitney Co.; quarterly of 1½ per cent on preferred, payable Nov. 15.

Holmes Resigns from Michigan Welding

DETROIT, MICH., Nov. 15—A. L. Holmes has resigned from the sales department of the Michigan Electric Welding Co., effective Dec. 1.

Big Drop in Car Securities

General Motors Leads with 300 Point Loss—Maxwell, Chevrolet and Overland Drop

NEW YORK CITY, Nov. 13—Liquidation of automobile issues had the usual effect upon prices. Drops of from a fraction to 300 occurred. The recession, however, has not been taken seriously by automobile shareholders. October and November are generally poor months for automobile shares. With the approach of the automobile show, it is stated, motor shares will get stronger.

The most pronounced declines were shown in Chevrolet, Maxwell, Studebaker, Willys-Overland, and General Motors. The latter company featured the recession with a drop of 300 points from 810 to 510. Notwithstanding the depressing conditions of the market, there were several outstanding gains made by several of the stocks. Ajax Rubber, in face of the usual declines, has made an advance of 8⅝ points in 14 days. The company's stock within the last 2 weeks has sold as high as 77. White stock has also shown strength.

M. & A. M. Show Week Schedule

NEW YORK CITY, Nov. 13—The Motor and Accessory Manufacturers announces the following events scheduled for show week, Jan. 7, as follows: Wednesday, Jan. 10, executive committee, banquet committee, finance committee, and board of directors' meetings at association's offices; thirteenth annual meeting at Waldorf Astoria at 3 o'clock, followed by the ninth annual banquet at Waldorf at 7.30 p. m.; Thursday, board of directors meeting at association's offices.

Pierce-Arrow Assets $13,776,911

NEW YORK CITY, Nov. 11—The total net assets of the Pierce-Arrow Motor Car Co., which were taken over by the Pierce-Arrow Motor Car Corp., Buffalo, last week, were on Oct. 1 valued at $13,776,911. It is estimated that by Dec. 31, 1916, this value will have increased $1,000,000. For the 7 months ended July 31 last net profits before depreciation were $1,660,000 for August $540,000; September, $560,000, making a total of $2,760,000 for the 9 months, which after depreciation show a net profit of $2,460,000.

White Stock on 8 Per Cent Basis

CLEVELAND, OHIO, Nov. 11—The White Motor Co. has declared a quarterly dividend of 2 per cent, $1 a share, placing the stock on an 8 per cent per annum basis. The stock has been on a 7 per cent per annum basis. The dividend is payable Dec. 31 to holders of record Dec. 15. The par value of the shares is $50.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	73½	74½	+3½
J. I. Case T. M. Co. pfd	87	90	+4
Chalmers Motor Co. com	130	140	+5
Chalmers Motor Co. pfd	112	115	+7
*Chandler Motor Car Co.	103	103½	—2
Chevrolet Motor Co.	173	177	—13
Enger Motor Car Co.	7⅜	8	..
Fisher Body Corp.	38	40	—1
Fisk Rubber Co. com	80	95	..
Fisk Rubber Co. 1st pfd	109	114	..
Fisk Rubber Co. 2d pfd	95	105	..
Firestone Tire & Rubber Co. com	1350	1400	+200
Firestone Tire & Rubber Co. pfd	106½	108	+2½
*General Motors Co. com	510	870	—300
*General Motors Co. pfd	122	124	—2
*B. F. Goodrich Co. com	68⅜	69	+3⅜
*B. F. Goodrich Co. pfd	113	114⅜	—1
Goodyear Tire & Rubber Co. com	294	297	+1
Goodyear Tire & Rubber Co. pfd	108¾	109½	..
Grant Motor Car Corp.	7	9	—1
Hupp Motor Car Corp. com	4½	5½	— ¼
Hupp Motor Car Corp. pfd	85	95	—7
International Motor Co. com	5	6½	—1
International Motor Co. pfd	22	27	—2
*Kelly-Springfield Tire Co. com	74¼	75½	—2¼
*Kelly-Springfield Tire Co. 1st pfd	96	100	—1
Kelsey Wheel Co.	55	56	..
*Lee Rubber & Tire Corp.	39½	39⅜	—2
Keystone Tire & Rubber Co.	15	16	..
*Maxwell Motor Co. com	71¼	72¼	—12¼
*Maxwell Motor Co. 1st pfd	82	82½	—3
*Maxwell Motor Co. 2d pfd	49½	50	—4½
Miller Rubber Co. com	242	250	+2
Miller Ruber Co. pfd	105½	106½	+ ½
Mitchell Motor Co.	58	60	..
National Auto Corp.	40	41½	..
Packard Motor Car Co. com	..	170	..
Packard Motor Car Co. pfd	94	99	+1
Paige-Detroit Motor Car Co.	37	38	—1
Peerless Truck & Motor Corp.	22½	24	— ½
Pierce-Arrow Motor Car Corp.	55⅜	56¼	..
Portage Rubber Co. com	165	169	—5
Portage Rubber Co. pfd	..	..	..
Regal Motor Car Co. pfd	20	30	..
Reo Motor Car Co.	46½	47	+ ¼
Saxon Motor Car Corp.	76⅜	78	— ⅜
A. O. Smith Co. com	43	43½	..
A. O. Smith Co. pfd	96½	96¾	..
Springfield Body Corp. com	93	96	—2
Springfield Body Corp. pfd	125	135	+5
Spicer Mfg. Co.	46¾	47	..
Standard Motor Construction Co.	7	8	..
Stewart Warner Speed. Corp. com	109	112	—1½
Stewart Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	123½	124	—5
*Studebaker Corp. pfd	112½	115	..
Stutz Motor	64⅜	65⅜	..
Swinehart Tire & Rubber Co.	88	91	—2
United Motors Corp.	61⅝	62	—2⅜
*U. S. Rubber Co. com	59⅝	60	—1⅜
*U. S. Rubber Co. pfd	111	111½	—1
White Motor Co.	55	55⅜	— ⅜
*Willys-Overland Co. com	37	37¼	—5½
*Willys-Overland Co. pfd	100	101	—3

*At close Nov. 13, 1916. Listed New York Stock Exchange. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	42	44¾	— ½
Chalmers Motor Co. com	126	..	+2
Chalmers Motor Co. pfd	109	..	..
Continental Motor Co. com	37⅜	38½	+ ⅜
Continental Motor Co. pfd	9½	10⅜	..
Ford Motor Co. of Canada	293	300	..
General Motors Co. com	..	825	..
General Motors Co. pfd	..	126	..
Maxwell Motor Co. com	74	76½	—9½
Maxwell Motor Co. 1st pfd	82	84½	—2
Maxwell Motor Co. 2d pfd	50	52½	—2½
Packard Motor Car Co. com	160	168	..
Packard Motor Car Co. pfd	100	102	..
Paige-Detroit Motor Car Co.	37	..	—1
W. K. Prudden Co.	..	50	..
Reo Motor Car Co.	46¼	47	+ ⅜
Studebaker Corp. com	123	126	—3½
Studebaker Corp. pfd	109	..	..
C. M. Hall Lamp Co.	..	31	..

INACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd	20	..	..

Traffic Laws to Be Clear

To Affect All Vehicles and Will Be Uniform in All States —Registration Included

WASHINGTON, D. C., Nov. 18—Simplification is to be the keynote of the new uniform motor vehicle and traffic law which will be promulgated in a short time by the legislative board of the A. A. A. The motor vehicle laws now on the statute books of most of the States are unnecessarily long and cumbersome. Duplication and further confusion exists where a State has separate motor vehicle and traffic laws on its books.

"Highway traffic in its final analysis is but a single problem," says Chairman O. I. Yeliott, "whether it relates to motor cars, horse-drawn vehicles, traction engines, or pedestrians. Traffic should be handled as one problem by one general set of laws, so that the rules governing one particular kind of traffic may fit into and be consistent with those governing all other kinds of traffic.

"The details of the uniform law to be framed by the A. A. A. board have not yet been fully worked out, but it may be stated in a general way that the first sub-division will deal with general provisions relating to the applicability of the law and definitions of terms used therein. The second sub-division will deal with the appointment, powers, and duties of a State traffic commissioner, who will have general supervision of traffic of all kinds on the public highways. The third sub-division will deal with the registration of motor vehicles and operators. The fourth will deal with the operation of vehicles of all kinds on the public highways, as well as with the conduct of pedestrians thereon. The fifth will deal with the enforcement of the preceding provisions.

"Thus each sub-division of the proposed law will be almost wholly self-contained, thereby doing away with a great deal of the confusion which now exists in so many State laws by reason of different kinds of provisions being intermingled. But the idea of simplification will be carried still further. The provisions relating to the traffic commissioner will be made quite brief and very simple. One section will define his duties; another, his powers; both in like general terms. Broad provisions will be used to extend these duties and powers as far as may be necessary to accomplish the general objects of his appointment. The courts, as a rule, may safely be trusted to amplify provisions of this kind with much more satisfactory results than where the law-maker himself attempts to enumerate all such duties and powers in great detail."

Earle & Boggs Enlarge Accounts

NEW YORK, Nov. 14—Earle & Boggs, this city, manufacturers' representatives, will add to its account the Buda Co., Harvey, Ill., and the Fuller & Sons Mfg. Co., Kalamazoo, Mich., its territory covering the States east of the western boundary of Pennsylvania. They also handle the accounts of the Blood Bros. Machine Co., Allegan, Mich., and the Pierce Governor Co., Anderson, Ind.

Fosdick Plans Automotive Company

BOSTON, MASS., Nov. 11—The Harry Fosdick, Inc. was formed here to-day. While its primary object is to deal in Pathfinder cars for New England, its main object is to go into everything possible along the lines of automotive power. Mr. Fosdick has been working on the plans for the past 6 months. The charter grants the right to sell, manufacture, buy and deal in all automotive powers, including automobiles, aeroplanes, marine, railroad or anything else that moves with a motor. The company has a capital of $20,000, and has leased temporary salesrooms here.

Mr. Fosdick's idea is to begin operations to meet the future which he realizes will mean the adoption of motors more generally for aeroplanes, submarines, vessels of all kinds, and even for railroads. William Hilliard, who was formerly with him, and who spent much time with the Burgess Aeroplane Co., learning to handle aircraft, has joined him. Mr. Hilliard, who was also with the Pathfinder, is known as the winner of the Climb to the Clouds, and for winning the light car race at Savannah with a Lancia.

C. & C. Co. To Handle R. I. V. Ball Bearings

NEW YORK, Nov. 13—The C. & C. Sales Corp. has been formed by I. R. Caplan, formerly connected with the R. I. V. Co. and Belmont Corp., formerly purchasing agent for Fiat, Poughkeepsie, N. Y. The company will deal in various types of anti-friction bearings, having taken over the R. I. V. Co.'s entire stock, for which it will be retail sales agent.

Fulton Takes C. & E. Products

MILWAUKEE, Nov. 13—The Fulton Co. has taken over the entire output of the C. & E. Mfg. Co., Marshalltown, Ia., the principal products of which are cutouts, Ford wheel pullers, accelerators for Fords, pedals, fender braces and camshaft bearings for Fords. These will be distributed to the jobbing trade in the United States and Canada.

New 3500-Mile Alliance Tire

ALLIANCE, OHIO, Nov. 13—The Alliance Tire & Rubber Co., the corporation which has succeeded The Alliance Rubber Co., Alliance, Ohio, announces a 3500-mile tire for 1917, a product that will be marketed at a low figure to the retail trade.

Peter A. Frasse & Co. 100 Years Old

NEW YORK CITY, Nov. 13—"One Century in Business" is the title of a booklet just issued by Peter A. Frasse & Co., this city, Philadelphia, Buffalo and Hartford, commemorating the opening of its first store in this country. This company is one of the large dealers in steel tube and tool steel, also mechanics' tools and machinery supplies.

Plan Tests of Fuel Consumption

Wisconsin Good Roads Assn. to Determine Relative Effects of Road Conditions

MILWAUKEE, WIS., Nov. 11—Exhaustive tests and demonstrations to determine the relative consumption of gasoline by motor vehicles on different types of highways, and also on roads in good and bad condition, have been arranged by the Good Roads Assn. of Wisconsin. The tests will be undertaken as soon as possible under the direction of Prof. M. F. White, department of agricultural engineering, University of Wisconsin, with the assistance of F. A. Cannon, secretary of the roads association.

The first tests will be made in Milwaukee county, which contains more than 100 miles of concrete highway, and also many miles of poor dirt, gravel and macadam highways not yet improved, thus offering the extremes of road and haulage conditions. The work will be done in this manner: A wagon will be loaded with a fixed load of agricultural products, say 2000 lb., to which will be hitched a pair of horses. By means of a dynamometer the tractive effort, resistance or pulling power will be fixed and determined.

Allen Bour-Davis Southern Sales Mgr.

DETROIT, MICH., Nov. 11—Robert Allen has been made the southern district sales manager for the Bour-Davis Motor Co., Mr. Allen was formerly the manager of the Dallas, Tex., branch of the Chevrolet Motor Co.

Livingstone Maxwell Cleveland Manager

CLEVELAND, Nov. 12—J. Livingstone has been appointed manager of the Cleveland retail branch of the Maxwell Motor Co. Mr. Livingstone was formerly assistant branch manager for the Studebaker Corp. at Indianapolis and Omaha.

Cole Has Service Conference

INDIANAPOLIS, IND., Nov. 10—More than 100 service men employed by the various important distributors and dealers of Cole cars have been assembled in Indianapolis by the Cole Motor Car Co., for their first service men's conference to outline a new service program which has been adopted.

Miles Is Buyer for Lewis Motor

DETROIT, MICH., Nov. 13—F. E. Miles has become the purchasing agent for the Lewis Motor Corp. Mr. Miles was formerly connected with the National Motor Vehicle Co.

Paige Wins Desert Race

Negotiates 273-Mile Phoenix-Douglas Course in 8 Hr. 30 Min.—14 Entered

PHOENIX, ARIZ., Nov. 13—E. L. Cord, driving a Paige, won the 273-mile Phoenix road race in 8 hr. 30 min., or 30 m.p.h. P. Thomason, driving a Buick, came in third, his time being 8 hr. 40 min. Fourteen cars started and five of them finished.

Entry in the race was open to cars and drivers from Arizona, New Mexico and Texas, with the condition that both driver and entrant must have been a resident of one of the three States for 6 months prior to the race. The race started at Douglas and finished at the State fair ground, Phoenix. The course followed the Borderland highway from Douglas to Phoenix, including some of the fastest stretches of desert road in the southwest and some tortuous sections of mountain and desert road. Hugh Miller holds the course record of 7 hr. 4 min., in 1914, made in the Pope-Hartford that be drove to-day. The race was conducted under sanction of the A. A. .A. and by the Arizona State Fair Commission.

Uniontown Speedway Nears Completion

UNIONTOWN, PA., Nov. 13—The local 1⅛ mile speedway is now nearly completed and will be ready for practice the latter part of next week. The total number of entries to date for the race meet on Nov. 30 is fifteen. In addition to the $4,250 offered in cash prizes for that day, C. W. Johnson, president of the speedway association, received a special prize in the form of a trophy valued at $3,000, to be known as the Universal Trophy, presented by Carl Laemmle, president of the Universal Film Mfg. Co. This trophy is to be contested for a period of 5 years at Uniontown, according to the terms on which it is offered.

Maxwell Makes Speed Test Run

DETROIT, MICH., Nov. 11—A Maxwell stock car, driven by Ray McNamara, completed a speed test from Detroit to Kalamazoo and return in 9 hr. and 45 min., covering a total distance of 350 miles, with an average running speed of 36 m.p.h.

The test was held, preliminary to the engagement of a Maxwell stock car in a contest which may arise as a result of the Maxwell challenge issued recently to all cars selling for $1,000 or less. The route taken included the towns of Lansing, Grand Rapids, Kalamazoo, Battle Creek, and Jackson, and the run was officially observed and checked by Detroit newspaper men. More than 50 per cent of the run was made over roads that were in the worst possible condition for touring and in several places the car was forced to make long detours because of construction work.

The start was made from Detroit at 3.15 a. m. and the car was checked into Detroit at 1 p. m.

Chevrolet Makes Promotions

OAKLAND, CAL., Nov. 13—R. C. Durant, son of W. C. Durant, has become sales manager of the Chevrolet Motor Co. of California. He was formerly assistant sales manager. W. A. Coleman has become assistant sales manager. Norman DeVaux has become general manager of that company, his former position being sales manager. They will make their headquarters at the local assembling plant.

T. L. Coleman has become sales manager of the Chevrolet Motor Co. of Canada, Oshawa, Ont., succeeding H. Horsman, recently resigned. Mr. Coleman was formerly with the Goodyear Tire and Rubber Co., New York.

Milburn Branch Manager for Hupp

DETROIT, MICH., Nov. 14—E. W. Milburn has been appointed branch manager of the Hupp Motor Car Corp. at San Francisco. He succeeds E. A. Morrison. Mr. Milburn was formerly the coast representative for the Thomas B. Jeffrey Co.

Timken Employees to Own Store

DETROIT, MICH., Nov. 14—The 3300 employees of the Timken-Detroit Axle Co. plan to reduce the cost of living by the operation of a store owned by themselves. It will be known as the Cooperative Store of the Timken-Detroit Co. and will sell food staples to all employees at the lowest possible prices. L. R. Judson, welfare manager for the company, will supervise it.

Vail Rubber Changes Its Name

CHICAGO, ILL., Nov. 13—The name of the Vail Rubber Co. has been changed to Ehman Tire & Rubber Co., under which name the business will be continued. A. C Ehman is president, the other officers being Francis Lackner, vice-president and N. J. Flynn, treasurer. The company makes pneumatic tires, packing, gaskets, and mechanical rubber goods.

Olympian Offices in Pontiac

PONTIAC, Nov. 13—The general offices of the Olympian Motors Co. have been moved into the main office building formerly occupied by the old Flanders Mfg. Co.

Amateur Races for Chicago?

Series May Be Run on Speedway Under Mid-West Motor Club

CHICAGO, ILL., Nov. 10—It seems possible that next year will see a series of amateur races run on the Chicago speedway quite similar to those that were fortnightly events on the Brooklands track prior to the war. These races probably will be run under the auspices of the Mid-West Motor Club, which was formed this week by a number of those who took part in the amateur races held here this year and present plans include competition among all cars up to and including 230 cu. in. piston displacement.

American Speedways Assn. Formed

CHICAGO, ILL., Nov. 15—Speedway managers met here to-day and formed the American Speedways Assn. in the form of a national organization to standardize racing conditions and to draft up uniform regulations and co-operations in getting drivers in all events.

The meeting to-day held at the Chicago Automobile Club is the culmination of a number of previous futile attempts to organize during the past 18 months.

At this meeting a constitution was adopted and officers elected as follows: president, Harry Harkness, New York Speedway; vice-president, Allison, Indianapolis Speedway; treasurer, H. S. Lehman, Cincinnati Speedway; and secretary, T. E. Meyers, Indianapolis.

The following speedways had personal representatives present; Indianapolis, Uniontown, New York, Providence, Des Moines and Chicago. Cincinnati and Omaha sent proxies.

In the newly formed organization there are two classes of membership. Class A is open to speedways having a course of 2 miles in length or over and class B is open to speedways having a course of less than 2 miles. In each case those speedways will be admitted whose construction is approved by the membership committee of the association. Chief control will be in the hands of a governing board consisting of three representatives of class B and four representatives of class A. The governing board consists of Allison, Harkness, Reid, Lehman, and C. W. Johnson, of Uniontown, as class A members. F. H. Perkins, Providence and Samuel Orloff, Des Moines, are members of class B. The governing board and officers elected will serve until the next meeting in New York, Jan. 12.

The American Speedways Assn. supercedes the Speedways Assn. of America which it was intended to organize earlier in the year.

The Automobile

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Convincing Advertising

THE advertisements of the concerns constituting any industry is in general a good indication of the business ethics of that industry. In all new industries more or less undesirable advertising is bound to be published, but it is a satisfactory indication when a national organization such as the National Automobile Chamber of Commerce takes up the problem of advertising with the object of discouraging what might be classed as scare or fear copy and lending its influence to more positive forms of publicity.

Potential Quality Doubted

While scare, or fear, advertising might be looked upon as potential still it is questionable, after administering the psychological test, if such copy is as potential as other copy might be. There is generally a positive and a negative aspect to each subject. A good positive example of advertising is that of the Pennsylvania Railroad, which advertises the number of passengers it has carried over a certain period without a single loss of life. It would be difficult to find a more potential kind of copy. Other positive railroad advertising has had to do with block-signal systems, rock-ballasted roadbed, full crews and other assets.

Contrast such advertising with that copy which might be used, showing trains on their side in the ditch, passenger cars on fire and women and children being rescued, engines colliding head-on and trains crashing through weak bridges. Such fear copy that might be used would in general build up through the traveling clientèle a feeling of fear, a feeling that would not engender a love for travel, but that would rather induce you to stay at home. The effect would be negative rather than positive.

Negative Tendencies Undesirable

In all advertising copy relating to automobiles and the industry the message to be conveyed is not one of fear or scare but one of desire to own and use an automobile. Every picture used in an advertisement that suggests accidents and the horrors that follow them is a possible source of injury. It has a negative tendency in that its influence breeds fear for the automobile rather than confidence in it.

Clutches and Winter

MISSING motors and clashing gears seem to be particularly common in the cold weather which has just commenced to settle over the country. The first item can of course be laid at the door of the heavy fuel which is difficult of vaporization. The second, however, can be traced to a defect which should be rectified in some of the clutch designs.

There is a tendency to drop the clutch brake and in place of this substitute a quick releasing device which will disengage the driving from the driven members instantaneously. This trend of design is no doubt a matter of progress, but one phase which must be watched is that the stiff lubricant which is attendant upon cold weather does not interfere with the action of the clutch.

The lighter weight clutches which are coming into use year by year naturally have less tendency to spin, and therefore lessen the danger of clash and also are not prone to drag. The effect of the heavy oil on even a light-clutch member is sufficient at times to give this clash. In fact, it will be so severe in some instances that it is difficult to pull the gears out of mesh after the clutch pedal is depressed, and when they are re-engaged the grinding noise which is particularly noticeable at this time of year ensues.

The remedy is, of course, in having the disengaging mechanism positive as well as quick. At the same time the leverage on the clutch pedal must not be reduced because with the ever-increasing number of women who drive it is necessary to keep in line with the tendency of having the force required to disengage the clutch as small as possible. Furthermore, the amount of motion of the pedal cannot be too great, because it will make the car unsuitable for a large number of leg lengths. This opens up a problem which is of course nothing new to the clutch builder. The amount of clutch member travel must be small, it must be quick to reduce spin, and in all the lubricated forms of clutch it must be absolutely unaffected by changes of oil viscosity due to temperature changes.

Steering Gears Offer Many Opportunities

Details of Layout and Construction Present Field for Enterprise—Truck Type Problems Differ from Passenger Car Requirements—Elimination of Wear

By J. Edward Schipper

STEERING gear design is largely a matter of compromise. It is a compromise between what is mathematically perfect and what is attainable practically; between stress on the driver and stress on the mechanism; and again between quickness of action and effort required to manipulate.

With this three-fold problem, each having its answer in a compromise, it is human to conclude that there will be a great variation in opinion, and this is true regarding the generalities of steering gear design as well as of the details.

Steering gears are probably the part of the car which has undergone the least change in the last 5 years and there are many cars to-day using the same gear as they did in 1912, with the exception of a few refinements in the direction of reduced weight and the changes required in shifting the gear from the right to the left side of the car.

Two big factors enter the design of the steering gear, and these determine practically every point in relation to the gear. They are:

First—the car weight.

Second—the car speed.

The layout of the gear is governed largely by the wheelbase and the structural details of the frame, but the steering gear itself depends upon the two factors named.

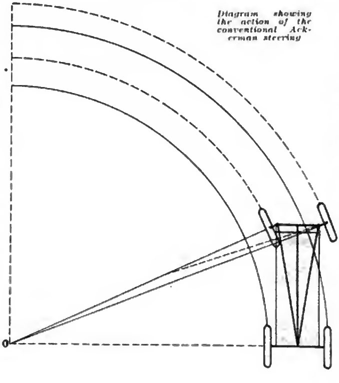


Diagram showing the action of the conventional Ackerman steering

Truck Designs Differ

Because a truck is heavier and slower than a passenger car, it necessarily has a different kind of steering gear. Theoretically the layout would be the same for both machines if they were of the same wheelbase, but practically, it is necessary to have a great reduction in the truck because it is heavier and naturally takes a greater leverage to turn the wheels; and secondly, since the truck acts at a slower rate of speed, the reduction can again be greater because it is not so necessary to be able to turn the wheels from one side to another so quickly.

Owing to the great inertia of a moving loaded truck it is not desirable to make quick turns with the front wheels on account of the tremendous stresses involved by the inertia force and the high center of gravity. With a passenger car, the wheels must turn quickly in order to make the vehicle good for traffic work.

The passenger car problem calls for the reduction gear in the steering mechanism to have a final ratio that will give the result desired in quickness and at the same time the gear must prevent the reception of road shocks by the driver, or, in other words, it must not allow the wheels to be swung out of their proper line or the steering wheel turned by every little impact between wheels and road obstructions. In other words, the gear must be to some degree irreversible.

The term irreversible in itself is confusing, because it has no exact meaning when applied to steering wheels beyond the rather indefinite condition that it means that any ordinary road wheel impact will be insufficient to turn the steering wheel. It is simply a question of reduction between worm and gear, sector or nut, whichever system is used. The greater the reduction, the less reversible the system and likewise the slower the motion of the road wheels in relation to the movement of the steering gear. Hence, the steering gear for a heavier car will be normally less reversible than the steering gear for a lighter vehicle.

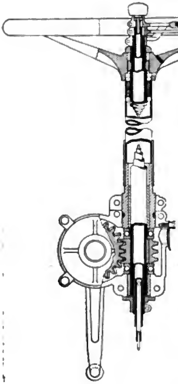
Elimination of Wear

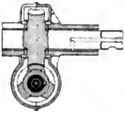
The straight mechanical problem of steering gears is to eliminate wear. This occurs in all the joints, the order of progress of wear being first the link joints at either end of the drag link and tie rod; and next between the worm gear or nut and the swivel joints. The order of wear is very much the same as the order of lubrication difficulty, and where the different steering gears differ largely is in these points where different styles of ingenuity are employed to get the joints so that they will retain the grease and at the same time allow it to be applied at the proper points.

There is also a variation in the grades of lubricant used. The Warner company, for example, recommends a heavy graphite grease as a general rule, although it states that in very cold weather a thinner oil would be of advantage. The great point of importance is that the oil or grease is retained in the gear once it is put there so that the operation of oiling the gear will not have to be repeated over frequently.

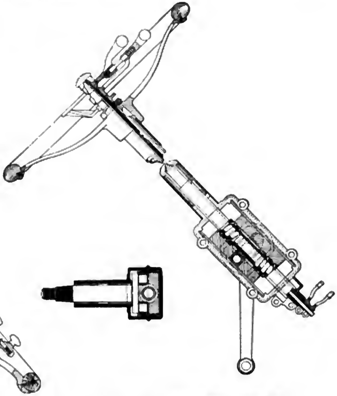
Lubrication Points Inaccessible

There are at least seven important points to lubricate on a steering gear, and none of them is accessible for a man who has good clothes on, therefore, as far as the passenger car owner-driver is concerned, he will not lubricate the gear until two conditions obtain, first that he has on a set of working clothes and second that he thinks of the gear. In many cases the first of these circumstances is rare, and in many more instances the second circumstance is still more rare. The combination of the two, therefore, will be so much of a long chance that steering gears must be designed to hold enough oil and grease to furnish lubrication for a long time. The majority of steering gear manufacturers favor a light transmission grease.

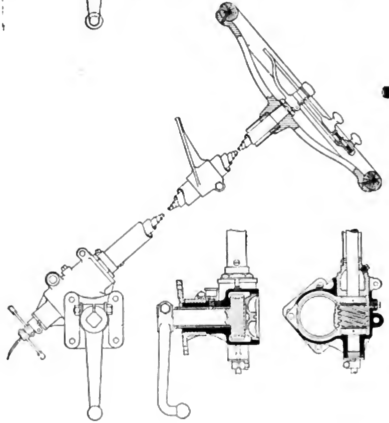




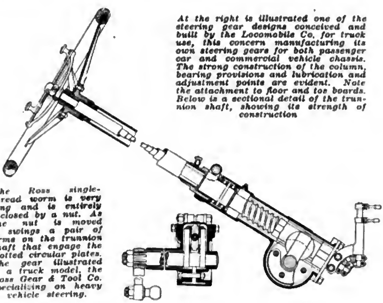
At the left is a sectional view of the model K Gemmer steering gear for left hand mounting. The ratio is 7½ to 1. One of the outstanding features is the sturdy but not massive construction, which insures safety in this most important of automobile parts, while at the same time eliminating all superfluous weight. Below is shown a section through the worm used in this gear. The maker is the Gemmer Mfg. Co.



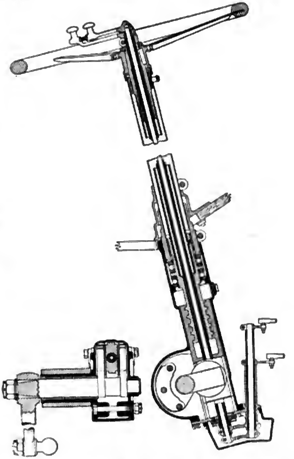
Above is the Lavine gear which uses a divided nut operating on right and left hand threads cut in a double worm, each of the blocks of the nut having a worm. The steering arm is operated through a rocking arrangement. To the left of the steering gear is a detailed section showing the trunnion shaft, its bushing, trunnion block, etc. The Lavine Gear Co. is the manufacturer



To the left is a Warner steering gear which is widely used and which is representative of modern worm and wheel practice. There is an adjustment for the thrust bearing behind the worm. Note the bracket midway up the steering column for attaching to the cowlboard or dash and also wiring for the horn. Immediately to the right of the steering gear is a sectional view showing details of the trunnion shaft and farther to the right is a similar illustration of the worm assembly. This gear is made by the Warner Gear Co.



The Ross single-thread worm is very long and is entirely inclosed by a nut. As the nut is moved it swings a pair of arms on the trunnion shaft that engage the slotted circular plates. The gear illustrated is a truck model, the Ross Gear & Tool Co. specializing on heavy vehicle steering.



At the right is illustrated one of the steering gear designs conceived and built by the Locomobile Co. for truck use, this concern manufacturing its own steering gears for both passenger car and commercial vehicle chassis. The strong construction of the column, bearing provisions and lubrication and adjustment points are evident. Note the attachment to floor and toe boards. Below is a sectional detail of the trunnion shaft, showing its strength of construction

In the design of the gear itself, it is generally believed that the kind of gear employed is not so important as to have the gear of proper design. This materially affects the lubrication, as it bears directly on the pressure exerted on the surfaces. The pumping effect on the steering gear is very slight, so it is difficult to keep the lubricant properly distributed and therefore another feature to compromise arises. The unit pressures must be kept down on one hand, and, on the other hand, the thread area of the worm must not be too great.

The Two Schools of Design

Referring this matter to the two different schools of design, the worm-and-split-nut and the worm-and-gear, the probabilities are that in the worm-and-gear type the pressures run quite high, because of the nature of the gears there is simply a line contact; whereas with the worm-and-split-nut type the thread area has a tendency to become so large that it is difficult to permit the lubricant to reach the innermost threads unless a very light oil is employed.

Allowable Backlash

All the wear in the different joints is reflected in backlash in the steering wheel. Fortunately, adjustments are provided on all the gears to get this lash out, because it becomes annoying at first and then dangerous, as a car with too much is apt to commence swaying on a down grade, and the sway becomes greater and greater until it reaches the limits of safety unless retarded.

Exactly what should be the allowable backlash in the steering wheel is subject to a difference of opinion. The Jackson, Church and Wilcox company states that the ideal is a 0 backlash. Warner states from 1 to 1½ in. is permissible. As a matter of fact, everyone knows that it should be kept as small as comfortable. Even drivers will differ, however, on what constitutes a fair amount of play and what is bothersome, but the steering gear manufacturer cannot adjust every product to the individual desires of the driver, so a standard has to be set and adhered to in each factory, and this ranges between the limits of practically 0 to 1½ in. A slight play generally helps to reduce shock.

Steering Pivot Tilt

If there is one change in steering gears, it is probably in arranging the steering pivot tilt. This has been increased in the last year or two, in order to help in attaining the so-called castor effect. In laying out the steering gear on the Willys-Overland cars, an angle of more than 5 deg. is given every steering pivot, to make it hold the road. On the other hand, a tilt of more than 10 deg. is extreme and it will be very difficult to make the car hold a turn on account of the great tendency for it to straighten out. This would make a desirable car on a long, straight road, but an undesirable one on a twisting road. Here again there must be a compromise and a moderate tendency to straighten out gained, without causing a tiring effort to hold the wheels on turns.

Tilting the Axle

Tilting the axle gains the same effect as tilting the steering spindles and even the flattening of the front springs has been a decided help in making cars hold the road. It is not all design, however, as soft front tires will counteract the best of steering layouts, or if the weight on the rear axle is greater than that on the front, there will be a decidedly unbalanced car to drive, the tendency being for the car to try to have the rear end catch up with the front wherever the course deviates from a straight line or lies over a slippery stretch.

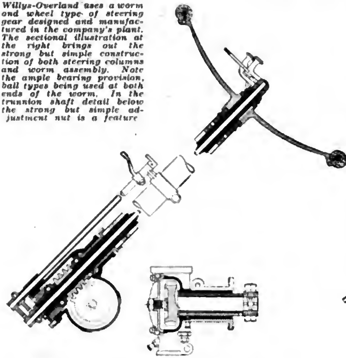
Adjustments Are Complete

Steering gears are all particularly complete in the matter of adjustments. This allows the driver to hold the backlash in the gears to just about the desired amount. Play in the wheels that is not detected in the steering wheel is due to variations in tightness of the linkage, and signifies worn parts, generally those which have either been neglected by the driver or which have bearing surfaces that are too small for the loads the gear is called upon to stand and hence have worn away too rapidly.

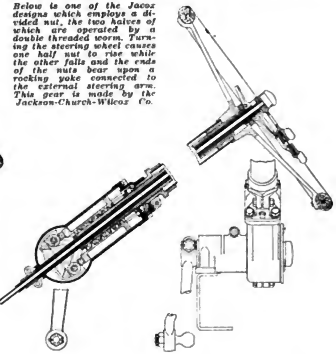
Bearings Are Renewable

Bushings are renewable even in the case of the worn parts, so that steering gear maintenance is really on about as good a basis as anything on the car. The trend of the times, however, will probably cause an improvement in gears in the

Willys-Overland uses a worm and wheel type of steering gear designed and manufactured in the company's plant. The sectional illustration at the right brings out the strong but simple construction of both steering columns and worm assembly. Note the ample bearing provision, ball types being used at both ends of the worm. In the trunnion shaft detail below the strong but simple adjustment nut is a feature



Below is one of the Jacox designs which employs a divided nut, the two halves of which are operated by a double threaded worm. Turning the steering wheel causes one half nut to rise while the other falls and the ends of the nuts bear upon a rocking yoke connected to the external steering arm. This gear is made by the Jackson-Church-Wilcox Co.



way of self-lubrication and again in self-adjustment. The self-aligning feature comes with the castor effect, the others are still waiting for full development. Oilless bearings are suggested for parts of the gear that do not have a great amount of motion, and they have been tried extensively and are in some use.

Worm-and-Wheel Adjustment

With the worm-and-full-wheel gear there are two adjustments possible; one method is to turn the eccentric bushing at the center of the wheel and the other is to turn the wheel, bringing a new surface into engagement with the worm. As the whole wheel is not used at once, this gives all of the effect of a new wheel. The latter method is generally preferred by manufacturers and it is recommended that the adjustments be made generally in this manner.

With the worm-and-split-nut type of gear, adjustments are simple. The Jacox gear is an example, as the gear is adjustable for wear by one single adjustment, and this is quite accessible. The adjustment is accomplished by loosening the bolt in the housing cap which locks the adjusting nut. The adjusting nut is then screwed down and locked. The adjusting nut bears directly on the thrust bearing which rests on the shoulder of the screw. When the adjusting nut is turned down, the screw is forced down against the threads of the half nut, the half nuts are in turn forced down against the rollers of the yoke shaft, taking up the wear on the threads of the half nuts and on the rollers.

Mechanical Layout Problems

Mathematically the layout of the steering gear presents a problem with ramifications that are not approached in any other part of automobile design. The mere statement of the problem of getting two pairs of wheels, one stationary and the other movable axially, to roll around a given point without sliding is sufficient to indicate the impossibility of ever securing in practice mathematically correct steering. As a matter of fact, the variation from the perfect is not so great as would at first be supposed, and although it cannot be said that the past year's improvement has brought us any closer to it, still steering, taken as a whole, is not unsatisfactory.

Practically every automobile has the same type of steering so far as the system is concerned, the Ackerman. With Ackerman steering it is assumed that the tie rod arms projecting from the swivels should meet at the middle point of the rear axle if their center lines are produced. Now, when on a curve the two rear wheels roll on two circular paths of different radii, and each wheel makes a tangent to its rolling circle, as viewed in plan. The front wheels meanwhile roll on separate circles of their own and the ideal steering gear is such that each of the four wheels should make a tangent to the circle along which it is rolling.

This true rolling can occur at three positions only: One is the straight position when the car is turning neither to right nor left, and the other where two wheels are at some definite angle of lock to right and left respectively. The effect for all other positions is that three wheels may roll perfectly, but the fourth must do some skidding, or perhaps two wheels roll and the other two divide the skid.

When Skidding Occurs

It is obvious that the rear wheels must roll on concentric circles and that the rear axle center line produced must be the diametrical line of the circles. Thus neither one of the rear wheels can skid unless both do. Suppose the point about which the car is turning is O, then the center lines of both the front wheel spindles must meet at O if every wheel rolls perfectly, without skidding. It is obvious that by turning the steering wheel we can bring one of the front wheels into such a position that the spindle center line passes through O, but the second front wheel will then take up a position depending upon the length of the tie rod and the layout of the tie rod arms.

Necessarily a Compromise

The practical geometry of steering gears involves a considerable amount of thought regarding the angles of the links and the intersections of link lines produced, and, as stated, the result from a commercial standpoint must always be a compromise. The difference between really good steering, however, and that of the average car is so marked that any improvements which would tend to make practice line up to a closer degree with theory would be welcomed, not only by the car owner but also by the industry.

Gearsets Simplified and Refined

Main Elements of Design Practically Unchanged—Adaptation to Unit Power Plants and Center Control a Continued Development—Provision for Tire Pump and Speedometer Drive

By Donald McLeod Lay

GEARSETS and clutches are so nearly inseparable in these days of unit power plants that the latter may well be included in a summary of the tendencies and refinements which mark the progress of gearset design during the past year. As was the case in 1915, there have been no radical alterations in construction or changes in basic principles. The leading tendency manifested during this year may be characterized as a general trend toward simplification, not only in manufacture and in the number and type of gearsets produced by each factory, but also in the reduction of the number of parts and slight alterations in the design of others which succeed in doing away with more or less complication and its inevitable accompanying weight.

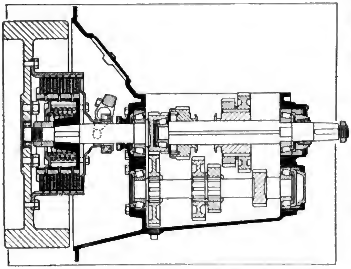
Unit Power Plant Gains

The continued trend toward unit power plant construction which became evident to such an extent last year has been emphasized by the increased production of multiple-cylinder engines, most of which are of the unit design. Naturally, gearsets have been improved in their adaptability to this type of mounting, not only by the methods of attachment, but also by the shape and construction of the bell housing, mounting of the clutch and improved bearing arrangement, although there has been comparatively little change in the latter respect. It was pointed out last year that the general adoption of the unit power plant had not led to the use of plain bearings throughout the gearset with pressure lubrication from the same oil pump that supplies the engine, and the comment was made that this seemed remarkable in that such a development could logically be expected. This year, however, there has been no trend toward such a construction. The manufacturers have not been idle on this question, but those who have been conducting experiments in the effort to arrive at a practical solution of the problem report almost unanimously that difficulty of securing satisfactory lubrication has to date rendered this impossible. Thus, ball or roller bearings continue to hold in practically all constructions for both portions of the mainshaft and, in fact, while some may consider them slightly more noisy than the plain bearing which they consider as the ideal, all the makers recognize their efficiency as a very close approximation of the latter.

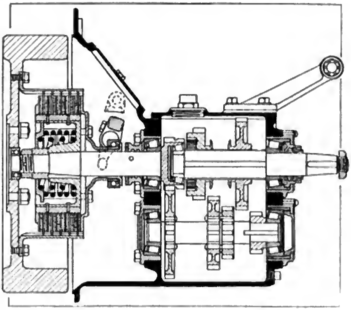
Iron has been increasing in favor as material for gearset housings, largely due to two considerations. One of these is the present high price of aluminum, and the other is the fact that iron seems to make a quieter casing than aluminum, in spite of being a more resonant metal. The greater rigidity of iron is one explanation put forth for this apparent contradiction.

Center Control Still Growing

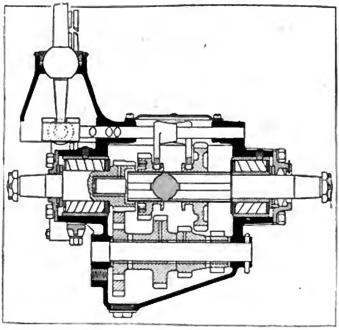
Center control, like the unit power plant construction, has been gaining so steadily that it is now almost standard, especially in the small, low-priced cars. The gearset manufacturers have welcomed this trend from the beginning, as it simplifies their work not only in designing and manufacturing their product, but also in the matter of expense, as it eliminates an enormous amount of material for rods, shafting, etc., which was formerly used up in adapting the stand-



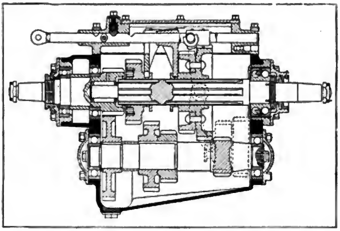
Above—Brown-Lipe four-speed gearset for unit power plant mounting. The company finds the demand for four-speed types for commercial car work to be gradually increasing, this applying especially to 3½ and 5-ton trucks. Where used for this purpose the gearset is universally furnished with direct drive on fourth speed



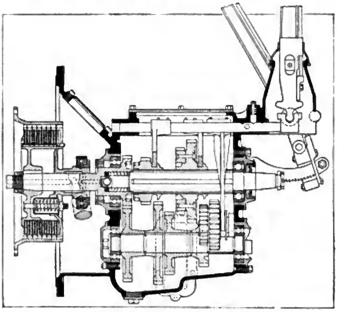
Right—Three-speed Brown-Lipe gearset, which is very like the four-speed design, having the same taper roller bearings. The sliding shaft is of square section. The use of a double clutch spring is characteristic of Brown-Lipe practice



Warner three-speed and reverse gearset with gears at ¾ in. space and 6-8 pitch. The main shaft is round in section with four integral keys and is carried at one end in a Hyatt roller and the spigot at the opposite end in a plain bushing with oiling facilities adequate to all conditions



Warner four-speed and reverse gearset with both shafts carried on annular bearings and with a spigot end of the main shaft carried on a roller bearing within the stub shaft. The main shaft has six splines on which the sliding gears move. The gears are nickel steel 1¼ in. face and 5-7 pitch. The speed reductions are: 4.99-1; 3.16-1; 1.79-1; 1-1, and reverse 5.78.1. Single race annular bearings are used for the countershaft. There is a double race bearing at one end of the main shaft and two single race bearings well spaced to support the short shaft at the opposite end



Warner four-speed and reverse gearset with nickel steel gears ¾ in. face and 6-8 pitch. Single race annular ball bearings carry both shafts. The spigot bearing on the end of the main shaft is supported in a Hyatt roller within the short shaft, and at this point end thrust is taken by a single ball. The gear ratios are: 2.73-1; 1.53-1; 1-1 and 1-1.251. The clutch assembly is a multiple disk type

ard gearset to the special requirements of various chassis.

While some of the gearset concerns still make it a practice to bring out special designs of housing cover plate and control lever mounting to suit the requirements of their customers, the majority build a standard design for center control chassis and adapt it to varying constructions by bending the levers either hot or cold. Regular models are usually available for right and left side lever mounting.

During the past year the makers have been able to still further simplify and refine their control mountings as compared with the 1915 designs, and many of them have arrived at such a point of development that it is necessary to cut only one hole in the floorboard for the passage of the levers, which are mounted, almost as a rule, upon the tops of the gearboxes. The connections between the control lever and the gears have been minimized and shifting is now very simple, requiring almost the least possible number of motions through the smallest distance, besides calling for the expenditure of considerably less energy than was the case in previous years. Last year much progress was made in this direction with the gearsets, but clutches lagged somewhat, a situation which has largely been remedied during the past 12 months by the increased popularity and more general adoption of the dry-disk type, which has now secured a commanding lead over its old rival, the cone. One of the greatest advantages of the dry-disk type is that the inner member can be made extremely light, so that shifting becomes correspondingly easy. Furthermore, for such a light-weight clutch no clutch stop or brake is necessary and the action is equally easy whether the operator is changing from an upper gear to a lower or the reverse. A good clutch brake makes the upward shifting with a cone clutch as easy as with the disk type, provided the weight is kept fairly low, although the extremely light construction which characterizes the dry disk is out of the question with a cone construction.

Clutches Are Better Inclosed

Clutches naturally share in the advantages conferred upon the gearsets by improved methods of inclosure. As an example of the progress made toward the ideal of a small, light, compact clutch unit of maximum efficiency as a transmitter of power, the Borg & Beck three-plate, dry-disk type may be mentioned. This unit also is fitted with a simple method of adjustment, requiring only the shifting of two bolts arranged diametrically opposite one another and working in slots in the housing. One mount produced by this firm combines a flywheel and clutch chamber in one casting. The other model is characterized as a self-contained design, the clutch being furnished in a separate inclosed casing which has a mounting-flange that bolts against the flywheel web.

One of the special features of this clutch is the ease of cleaning. Kerosene may be squirted into it, washing out the gummy substance which is caused by the sediment which mixes with the oil. The clutch may slip for a time after the kerosene has been applied, but the slippage soon disappears.

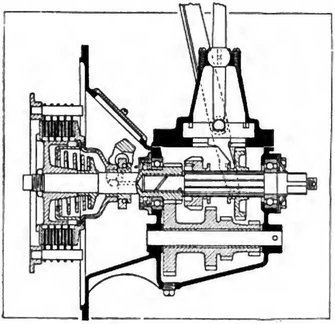
The four-speed gearset is now used in only a few of the high-priced cars, the development of multiple-cylinder engines rendering it unnecessary except as an additional refinement or touch of luxury. Three speeds may now be considered practically standard for gasoline passenger car construction. For truck use, however, the four-speed gearset is becoming increasingly popular, Brown-Lipe pointing out that this type is in growing demand, especially for 3½ and 5-ton trucks. The Cross Gear & Engine Co. finds an increasing demand for 1-to-1 ratio on high where four-speed constructions are used for commercial vehicle chassis.

Gear ratios have been determined by the manufacturers largely through observation during years of experience and experimentation. Brown-Lipe is an example of this, others being Mechanics Machine Co., American Die & Tool Co. and Grant-Lees Gear Co. The Warner Gear Co. states that too much variation in the conditions of the range covered by standard models prevents the provision of ideal gear reductions. This company endeavors to arrange the gears approximately in geometrical progression, varied of course, according to circumstances.

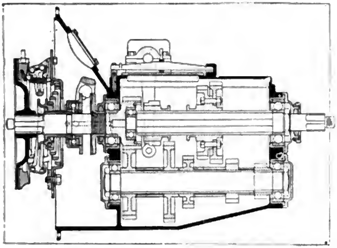
There seems to be some tendency toward the wider use of a stationary countershaft. Either plain bushing or straight roller bearings within the countershaft gears are used as a rule. With the Warner Gear Co. construction the countershaft gears are cut in pairs mounted on plain bronze bearings and the two pairs are driven by clutch jaws between them. Integrally forged countershaft gears are used by a number of makers, the Mechanics Machine Co. using this construction on the four counter gears used in its smaller gearsets. Brown-Lipe makes the three smaller gears integral in its smallest model, mounting them on a plain-bearing countershaft. The American Die & Tool Co. uses a built-up countershaft with sliding gears bolted together in one model while in another it uses the solid forging with extensions at the ends which support it in the case and which run on ball bearings.

Interlocking Devices Universal

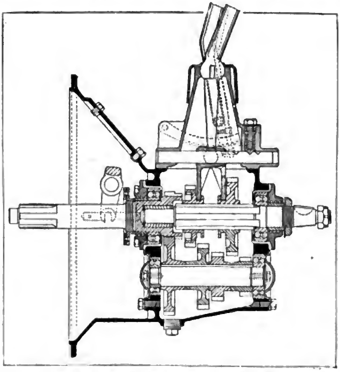
Interlocking devices to prevent the meshing of more than one gear at a time are almost universal. The Warner Gear Co. employs vertical plungers to give the gears their proper meshing position and plungers with a cross movement prevent more than the shift rail being moved at any given time. The Mechanics Machine Co. uses a small steel plate cast into the gearbox cover, this plate being notched for the gear change lever so that it is impossible to engage two speeds at once. When one set of gears is in mesh the lever is at one side of this plate and it is necessary to bring this through the notch and over to the other side of the plate before another set of gears can be brought into mesh. Three types of interlocks are used by the American Die & Tool Co., the ball or rod with spherical end between shift rods and the tilting bar mounted on a bracket underneath the sliding forks which



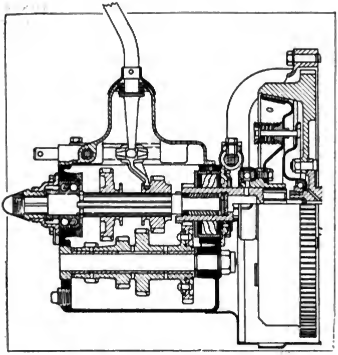
Mechanics Machine Co. three-speed and reverse gearset in which the main shaft is carried on annular bearings and the countershaft on plain bearings. The spigot end of the main shaft is carried in a plain bearing within the stub shaft. The main shaft is splined for the sliding gears. The ratios are: 1.5-1 on intermediate, and 3.4 to 1 on low. The clutch assembly is a multiple disk type with an inclosed conical engagement spring. There is a ball thrust collar for clutch disengagement



American Die & Tool Co. four-speed and reverse gearset with ball bearings for carrying main and countershaft as well as the spigot end of the main shaft. The main shaft is a circular cross section with 4-in. integral keys. The clutch assembly is a three-disk type with conical engagement spring and ball thrust collar for clutch actuation



Grant-Lees three-speed type of gearset. Gears are renewable separately and only one control housing is made. This is designed so that it is necessary to cut only one hole through the floorboard, the levers being bent cold to accommodate different bodies. Grant-Lees has changed from the gland stuffing box type to the spiral lead and plate

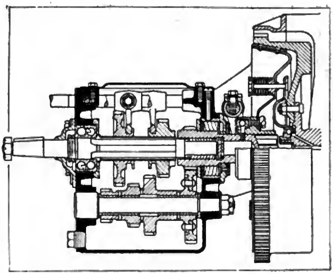


Northway three-speed design with reductions in the gearbox of 3.09 to 1 on low gear, 1.73 to 1 on second and direct drive on third. The reverse ratio in the box is 3.98 to 1. These ratios are, of course, multiplied by the rear axle for final reduction. The clutch used in this installation is a cone type with a ball bearing release

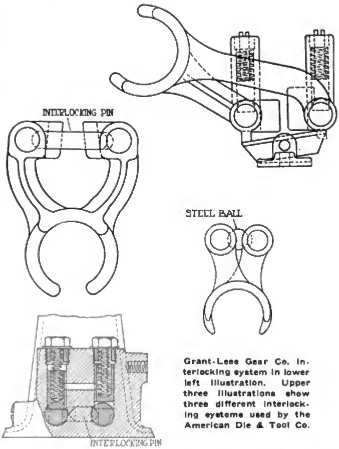
is pressed into a notch in either fork when moved from neutral. Grant-Lees uses an interlocking pin fitting between the two pull rods, the grooves in which are deep enough to accommodate this pin in neutral position to allow either pull rod to move forward or back but the guide hole in the control housing prevents the other pull rod from moving while one rod is out of the neutral position, either forward or back. The pin is hardened and very little wear is said to take place in continual use. In a new constant mesh four-speed design which Cross Gear is bringing out for truck and bus work, there is a special locking device, which is said to be positive in its action. Two of the shifting fork shafts are held in neutral position by locking pins, which pass entirely through them, while the third shaft is shifted into the required position.

Gear Face and Pitch

There seems to be a considerable difference among the gearset makers as to the quietest and most efficient types of gears in respect to pitch and width of face. Warner considers the finer pitch gears and those of narrower face as less likely to create noise, making the point that distortion is unavoidable during the hardening process as applied to wider gear faces. Brown-Lipe agrees in this contention but Grant-Lees considers stub toothed, coarse pitch gears more quiet in operation than gears of finer pitch of a given face. Thus for a ¾-in. face gear it finds a 6-8 pitch 20-deg. pressure angle has an advantage over 7-9 pitch 20-deg. pressure angle on account of less distortion in hardening although a coarser tooth 4-5 pitch would not be advisable for the same tooth width on account of the pitch diameters not allowing enough teeth to be in contact. The Mechanics Machine Co. does not believe that pitch and width of gear face have any great effect upon quietness but considers it inadvisable to make gears with less than thirteen teeth, counting on the care and manufacture to insure quiet operation. The American Die & Tool Co. reports that on various tests covering both 8-10 with 9/16-in. face gears and 6 and 6-8 with 1 in. and ⅞ in. face respectively, it has had both quiet and noisy operation.



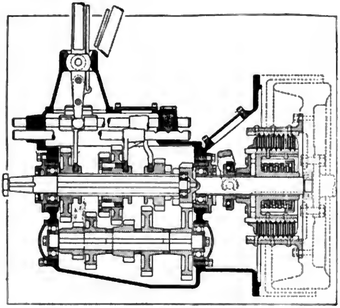
Northway gearset with main shaft on double annular ball bearings at one end and the short shaft at the opposite end supported on spiral roller with a similar bearing supporting the epigot. The clutch assembly is a cone type with small engagement springs regularly spaced. The countershaft is carried on plain bearings



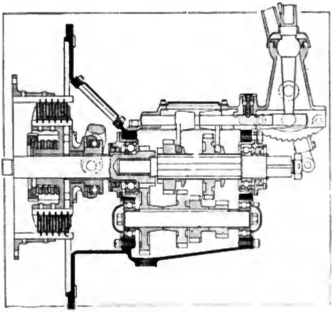
Grant-Lees Gear Co. interlocking system in lower left illustration. Upper three illustrations show three different interlocking systems used by the American Die & Tool Co.

It points out that the design in both cases has a bearing on the question, and when either of the sets is mounted in the cast iron housing even with ball bearings, noise has been a negligible factor. For standard practice this company considers the 6-8 pitch with the ⅞-in. face as most serviceable. Northway considers pitch, form of tooth and diameter important factors in securing a quiet gearset, the width of the gear face determining the duration of this quietness.

On the whole there is little tendency to make any change of the type or arrangement of bearings. Brown-Lipe uses

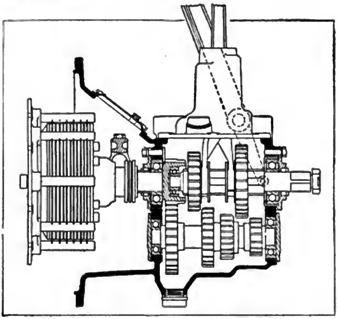


Muncie Gear Works vertical design gearset employing annular ball bearings throughout, including the spigot end of the main shaft. Gears are 5 pitch and ⅞ in. face. There is a ball thrust collar for clutch action and the clutch assembly of multiple disk type employs a double spring. The usual packings at each end of the main shaft are used to avoid leaking



Muncie Gear Works three-speed and reverse gearset using annular bearings throughout except at the spigot end of the main shaft, where a plain bearing is used. Gears are of 6-8 pitch. The main shaft is round section with four integral keys. Gears on the countershaft are held by keyway. The clutch assembly is inclosed within the usual flange construction

taper roller bearings throughout wherever possible in its standard constructions. Warner considers the use of either plain bushings or straight roller bearings within the countershaft gears and in connection with a stationary countershaft to be growing in favor. Northway finds a trend toward the adoption of spiral roller bearings type for the forward end of the main shaft and a double-row ball bearing in the rear. The American Die and Tool Co. has been using ball bearings throughout, its experiments with plain bearings on countershaft and spigot proving unsuccessful because of lubrication difficulties. For eliminating noise and reducing cost of manufacture this company recommends a combination of ball and roller bearings, or roller bearings throughout with a small roller bearing for the spigot.



Fuller & Sons Mfg. Co. gearset employing annular bearings throughout, including the ends of the spigot shaft. This unit assembly is made with flanges to fit all makes of motors

Tire Pump and Speedometer Mounting

Provision for demounting of tire pump and speedometer is becoming more general with the gearset makers. With the Grant-Lees design the tire pump base can be bolted to the gearset housing and is driven off the reverse idler gear. Northway makes provision on the left side of the gearbox for the application of the tire pump, the drive being secured in the same manner as on the Grant-Lees. Similar constructions or their equivalents are to be found on practically all of the standard gearsets now being manufactured. Speedometer drives from the gearset are now largely inclosed, an example of this being the Northway, in which the speedometer drive is contained in the rear bearing retainer.

Ease of disassembly and assembly has been one of the important aims of the gearset designer for some time and during the past year a number of concerns have made slight improvements in this particular, one of the most salient of which is the practice of having all the parts assembled outside of the case so that they go in as a unit and may be removed in the same way. With the now almost universal central location for the gearshift and emergency brake levers, control members are neatly and conveniently mounted on the cover plate of the gearset housing, which still further simplifies the task of disassembly. Another factor in this situation and one which simplifies to a great extent the matter of replacements, not to mention its accompanying reduction of expense in case of repair, etc., is the increasing adoption of separate units in the gearset which can be easily removed. Thus in case of stripping the teeth of one gear or some similar mishap, the car owner is not obliged to replace a large part of his gearset at considerable expense, as was formerly the case with some constructions.

Differ on Lubrication

In the matter of lubrication there appears to be a wide diversity of opinion among the gearset manufacturers, both as to class of lubricant which is most desirable and the frequency with which it should be renewed. Brown-Lipe recommends extra heavy fluid oil filling the gearbox only to the top of the countershaft, stating that this will give sufficient lubrication for any emergency and will avoid leakage around the various joints of the gearbox, a condition which the company states is almost invariably caused by high pressure due to heat expansion of the lubricant. This concern fits all its gearboxes with breather tubes to take care of this phase of the situation. Warner prefers transmission oils, stating that greases do not flow into the smaller spaces properly. This company has found that it secures best results with the oil depth about ½ in. from the top of the countershaft. Northway favors a fairly heavy grade of engine lubricating oil at a level about the center of the lower shaft. Manufacturers who do not agree with any of these views usually do not concern themselves with the matter, leaving the car builder to recommend whatever lubrication he considers best adapted for the gearset in its capacity as a unit of the chassis he is producing. On most of the modern gearsets oil level plugs are provided to determine the correct depth of the lubricant. Grant-Lees has changed from the gland stuffing box type to the spiral lead end plate, having found the latter superior in that it keeps the oil in the gearbox and requires no attention. The Cotta Transmission Co. recommends a medium light grease of a depth to cover both shafts of the gearset.

The majority of gearset makers agree that the lubricant, irrespective of the sort used, should be renewed every 5000 miles. Some, one of whom is Grant-Lees, consider that the lubricant should be examined once every 2 months with average driving, the frequency of renewing the lubricant depending upon how much the car is driven on its lower gears. Others, of whom Warner is an example, have secured best results when the lubricant is changed every 1200 to 1500 miles of car travel. When this lubricant is changed it is generally approved practice to drain out the lubricant thoroughly and then wash out the interior of the gearbox with kerosene oil.

Electric Gearshift Makes Progress

The use of electrically operated gearsets has made some progress during the past year, equipment of this type having been adopted as standard by a number of automobile companies, while several others have been conducting experiments with this method of control with a view to announcing it as standard or optional equipment about the first of the year.

For the future, little can be predicted as to probable alterations in the gearset and clutch design. It would seem most likely that present constructions will continue for some time without any appreciable change in their basic principles, the only alterations being in the way of refinements and simplification of parts or assembly and hence naturally of a minor nature. This state of affairs bids fair to endure until some radical developments in automobile construction call for correspondingly radical modification of gearsets and clutches as means for the transmission of power from engine to wheels.

Clutch Design Greatly Improved

Simplification Due to Elimination of Adjustments, Weight, Etc.—Disk Type Increasingly Popular—Fewer Plates Permit Increase of Pedal Leverage

By J. Edward Schipper

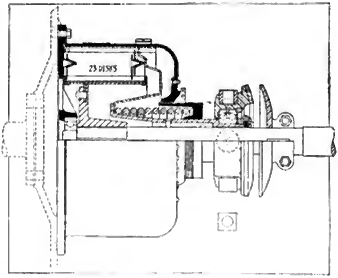
THE question of clutch design as shown by those clutch makers who supply to the automobile trade in general shows improvements from year to year. Elimination of adjustments and weight is the summation of clutch tendency in design as denoted by the changes during the past year. Broadly there is a tendency among the automobile manufacturers toward the employment of the disk rather than the cone. In the disk design itself there is a leaning toward the use of fewer disks.

If the figures on clutch weight per horsepower transmitted could be plotted in a curve they would show that this has been dropping, year by year. The aluminum cone for the cone type was one of the earlier indications of this and although the tendency is a little toward the pressed metal cone, the light-weight characteristic remains.

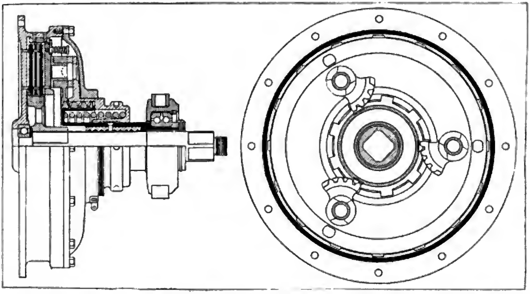
Lubrication Generally Automatic

Mechanically the clutch is a much simpler proposition now than heretofore. The adjustment points are fewer and the lubrication is generally automatic so that a clutch may go 50,000 miles without attention. Clutch wear is taken up automatically inside the assembly and on some of the prominent makes the only adjustment provided is that to prevent the pedal from striking the floorboard.

Another line of improvement is in the pedal linkage which permits clutch disengaged with much less effort. The leverage is increased in some instances directly on the pedal, but in general the reason for improvement is that the fewer plates on the disk clutch require less motion on the part of



Hele-Shaw standard No. 6 clutch with twenty-three disks for 40 hp. at 1000 r.p.m. This clutch is very widely used, being designed for flexibility and ease of operation in conjunction with positive engagement, insuring against loss of power in this unit of the transmission system. The case is of pressed steel, the core of steel and the presser is steel and malleable iron. Phosphor bronze is used for bushing and for the outer disk, the inner disk being sheet steel. The brake is of malleable iron with an asbestos lining

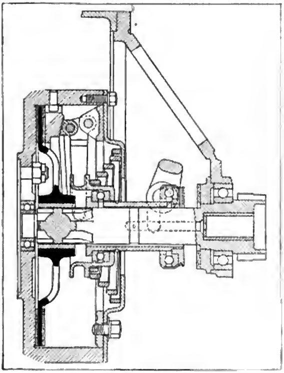


Hilliard Clutch & Machinery Co. disk clutch assembly with double annular bearing and inclosed spring. The forward end of the clutch shaft is supported within the flywheel disk by an annular ball bearing

the clutch linkage and hence it is possible to make this smaller travel up in increased pedal leverage.

The increased engine speed and greater reduction at the rear axle have influenced clutch design. It is naturally much more difficult to transmit in a given weight clutch, 40 hp. at 1200 r.p.m. than it is at 2500 r.p.m., the question being one of torque. With the greater rotative speeds of the clutch members, the torque transmitted at a given speed falls off and hence this will aid somewhat in clutch design, although factors of safety have increased rather than decreased, due to the use of better materials.

Lightness in clutch rotating parts is necessary if clashing of the gears is to be prevented. The clutch brake is an aid but independent of the clutch brake, makers have reduced the inertia and spinning tendency of the clutch members by a decrease in weight.



Borg & Beck clutch assembly showing three-plate clutch type with conical engagement spring and ball thrusts. The use of ball bearings is conspicuous in this clutch assembly

Ease of engagement is looked after in different ways in disk clutches, but with the cone, it is common practice to use about six bowshaped springs beneath the surface of the leather. On the clutch made by the Warner Gear company these are adjustable by means of screws on the inner side of the cone. There is no other adjustment.

With a ball-type thrust of two hardened and ground races of the best quality of material, and with the balls carried in a retainer that not only retains the balls but also a sufficient quantity of lubricant to take care of them readily, there is no need for an adjustment, as such an installation will serve indefinitely unless dirt or foreign matter enters. In that case, even an adjustment would not serve, as a replacement would have to be made anyway.

Cone clutch angles are about the same as formerly, running about 12 or 13 deg. Nothing has supplanted good quality leather as a facing for the cone. With the disk clutch the use of woven asbestos fabric quite similar to that used in brake installations is considered best by the majority. The leather is always riveted on with the rivets countersunk beneath the surface of the leather to secure against metal to metal engagement.

Engaged Area Decreasing

While with the disk clutch the total area of surface engaged is growing smaller, due to the falling off of the disk-in-oil type and the gaining of the dry-plate type, the trend is going the other way on the cone clutches. With the cone the surface area is less than the area given by the disk type, the difference being that it is more effective because applied at a greater distance from the axial center of rotation. The amount of clutch area in consideration for the work to be done, however, compares very favorably with the similar problem that comes up in brake design.

The Hilliard Clutch & Machinery Co. makes a feature of the point that no clutch brake is used. The spinning of the rotating members is prevented by simply having a combination of a quick-acting release which does not permit of a drag while releasing and further by having the parts so light, that the rotation does not continue long.

On the clutch made by Fuller & Sons Mfg. Co. the development has been typical in that all adjustments are eliminated. The clutch requires no attention except that the throwout bearing must be oiled occasionally. The only adjustment on the clutch is the adjustment which prevents the pedal from striking the floorboard. The clutch brake has been eliminated on all the Fuller clutches except the oil type, and in its place a quick releasing scheme with light parts has been substituted.

German Truck Design Is Improved

Commercial Vehicles Are Stronger But Lighter, Due to War Developments—Electric Types Gain—New Batteries Features—Gasoline the Fuel of the Army

By E. A. Langdon

WHILE passenger car design has made comparatively little progress in Germany since the outbreak of the war, motor truck construction has been greatly improved and the scope of both gasoline and electric commercial vehicles has been considerably widened. Strength and light weight are the features which most impress one in inspecting these machines, both being due to the need for economy in both construction and operation and to the use of lighter materials such as steel-reinforced wood frames, hydraulic spring systems instead of steel springs and other similar innovations.

Many Electric Trucks Used

The number of electric trucks has been greatly augmented, the ever-present necessity for economy being partially responsible for their popularity since current is unusually inexpensive, due to the abundance of coal Germany is mining from the northern section of France occupied by its armies. Highly efficient batteries of a new type have been developed because the demand for lead by the munitions factories rendered lead cells out of the question and the scarcity of nickel in Germany prevents the extensive use of the nickel-iron type. Gas batteries, in which slightly acid water is decomposed by the current on entering into oxygen and hydrogen, are said to be used in large numbers as reserve sources of current in stationary plants. When the oxygen and hydrogen is released from compression in the cathode and anode spaces through reduction valves they again combine as water, liberating current to the amount originally absorbed in the process of decomposition.

Gasoline Fuel for Army Cars

While gas obtained from distilled coal constitutes a large percentage of the automobile fuel used in the interior of the German Empire, gasoline is used almost entirely in military operations. The Germans consider their gasoline supply, at least sufficient for the needs of the army, to be secure for an indefinite period.

Material for spark plug terminals for a long time proved a stumbling block to German automobile engineers, as platinum is unobtainable. A new alloy has been developed, however, and is claimed to give very satisfactory results, although it has not yet had an opportunity to prove its serviceability in general use.

A Glass Cylinder Head

A number of interesting experiments have been made with new and unusual materials for automobile construction. One of the most novel of these was a cylinder head made of what looked like glass reinforced with wire fitted with valve seats of nickel steel. The material turned out to be an oxide of silica molded on a steel wire skeleton.

Wooden wheels are almost universally used on German cars and trucks, as the metal formerly employed in steel and wire types is now required for war purposes.

There are not many instances which illustrate so well the change industrial Germany has undergone during the last 2 years as the automobile situation in the interior of the empire. For life in general does not differ so very much from that in a normally operating country; the number of able-bodied men in the streets is considerably above what outsiders would imagine, and the people are fully as busy as in times of peace.

Few Passenger Cars on Streets

However, the moment one leaves a home, store or factory and enters the street, the abnormal condition of German existence becomes evident. For there is an absurdly small number of passenger automobiles, and what there are consist of old, invalid hacks, vehicles which nobody would think of using in normal times; and at the same time there is a very great number of commercial vehicles, but these, too, are of an entirely different type from what was seen before the outbreak of the war. Let us consider both of these phenomena.

All Good Cars Drafted

Passenger automobiles, like all things which are not a matter of absolute necessity, have become utterly negligible in German eyes—principally because they had to. The military operations at the front could easily employ all passenger automobiles German and Austrian factories could turn out, and more; and the absolute subjection of individual interests to those of the State has resulted in the drafting into service of every car which is at least 40 per cent efficient. These cars are used for the extremely rough work which frontal operations necessitate; and the result is that every part of the car suffers, though not in equal degree. Some of these machines, as has been described in a former article, are overhauled in field automobile hospitals, of which there are several at each front, and by this expedient the life of each car is increased, on an average, by 100 to 200 per cent. But finally the time arrives when the automobile can no longer be kept serviceable in this fashion, and when, in times of peace, it would be consigned without mercy to the junk heap. In war, however, the junk heap is merely the assorting department for the materials needed by the divers factories of the empire. Hence, these unserviceable automobiles are taken to one of the enormous plants handling this work of assorting waste materials—there are, in all, five such plants in Germany and Austria, employing in all close to 80,000 hands—where they are taken apart and segregated.

Some Parts Still Useful

Some parts of these disassembled cars with slight chemical treatment, can be used over in assembled cars which are continually being built for service at the front; other parts are put aside to be melted and entirely refashioned; whereas a minimum quantity of parts is always placed aside and used in the makeup of the passenger vehicles, police and ambulance wagons which are absolutely necessary in the interior. It stands to reason that these latter classes of vehicles are of a lamentable kind, most of the time entirely devoid of any design, and built rather along lines of expediency than of harmony or looks.

Progress in Truck Design

As for trucks, the difference between the importance given to them and that allowed for pleasure cars is most striking. For commercial vehicles are not only, without exception, harmoniously and suitably designed, but every one gives a decided impression of strength, coupled with light weight. The latter point is the result of two conditions; first, the necessity of economizing all sources of energy; second, the use of lighter materials than were the vogue before the war. These lighter materials include spruce frames stayed by steel braces, as well as combinations with other principles of construction. It is surprising to an observer not accustomed to these types of vehicles what strength can be obtained by these means, if proper weight distribution is had by suitably designed braces and stays and if the suspension is ample. German engineers are not tempted to false economy in this latter regard.

Hydraulic Spring Systems

Hydraulic spring systems, often including a set of different-sized cylinders arranged in suitable series to take gradually varying shocks, have become very common during the last 2 years. Some of these hydraulic shock absorbers, which, by the way, have almost completely taken the place of steel springs on commercial vehicles, are not working on the principle of internal friction in the liquid or between the liquid and arduous passages, but are so constructed as to utilize the resistance of the container against an outward radial stress, whereby advantage is taken of the full tensile strength of the metal.

Electric Current Cheap

In regard to economy of energy—the word "fuel" being purposely avoided in this instance—the number of electric trucks has increased enormously ever since the outbreak of the war, and is still increasing, for all purposes where automobiles are used on good roads; and, generally speaking, all roads in the industrial sections of the empire *are* good. Electricity is one of those many commodities the productions of which is now under governmental supervision, but current is surprisingly cheap; the explanation being, very likely, that the Germans are deriving great quantities of coal from the mines in the territory held in France. In many cases, where numerous trucks travel along fixed lines of transportation, as between industrial centers of moderate distance—railroads being used chiefly for purely military passenger and freight transports—the vehicles are propelled by single or double electric motors in place on the rear axles, current being drawn from overhead conduits by means of a trolley. Where the importance of a route is not great enough to justify the construction of such a conduit-wire line—and it is remarkable with what degree of "scientific management" and statistical study the Germans determine whether a route is of greater or lesser national importance—the trucks are fitted with batteries. Very little can be learned just now about the construction of these batteries; but it is certain that almost all are other than lead cells, though it is not very likely that they are of the nickel-iron type, as nickel is quite rare in Germany at the present time.

New Type of Battery

Apropos of these conditions, it is interesting to note that a great many lead batteries which served as reserve sources of current in stationary plants have been supplanted by an entirely different type of battery, as lead is needed in the making of ammunition. These novel batteries are said, in a number of cases, to be of the "gas" type, wherein water with a slight acid percentage is decomposed by the current upon entering, is stored in cathode and anode spaces in form of oxygen and hydrogen, being compressed there by suitably designed mechanism, and when the battery is drawn upon, the gases leave from their chambers through reduction valves in proper proportions and again combine to water, freeing the amount of electricity first absorbed in the decomposition of the liquid.

Poles Faced with Platinum Powder

The poles of this battery are faced with "Platinmohr," black amorphous powder of platinum, which is at once a good conductor of electricity and a good catalyzing agent, being used to a great extent in the making of sulphuric acid, one of Germany's most important industries. The use of this material for batteries shows how the industries of the empire have become linked and, as it were, reshaped along lines of "interchangeability of parts." For the sulphuric-acid industry has been drawn upon for much of the platinum used there and is now using in place of the platinum method, a new kind of "contact process," as they call it. This is only another illustration of how, so to speak, not a molecule of matter is lost within the empire, no matter how great a quantity is shot and burned away at the battlefield.

Soldiers Understand Gasoline Cars

The fuel of the automobiles used at the front consists almost exclusively of gasoline, and the reason for this is that hundreds of thousands of soldiers are well familiar with the operation of gasoline engine and average automobile, as well as with the chief points of its construction; consequently the risk of the personal equation is smaller in the case of the average gasoline car than if any other type of automobile were used. Moreover, the Austrian oil fields in Poland, the wells of the occupied Russian territory and what oil and oil products were imported from Rumania heretofore are ample for the requirements of the field automobiles, and the more perfect organization developed during the war has quite overcome the need of using industrial alcohol, or benzol, for that matter. At the time of this writing, it is a few days since Rumania has entered the war, and according to the military experts who predicted with fair precision the development of the Serbian campaign under General Mackensen, the Germans expect to be in secure possession of the Rumanian oil fields within less than 8 weeks. This, of course, is problematical, but the fact is that even if the Rumanian supplies of gasoline to Germany be cut off, the other two sources mentioned would suffice for the needs of the army—and navy, for the latter now includes a number of vessels, both of the submarine and light cruiser type, using kerosene or gasoline for propulsion.

Material for Plug Terminals

One of the difficulties experienced by German engineers lies in the terminals of spark plugs. Platinum, used solid or as a coat, is absolutely unobtainable, as Russia, the chief former source of supply, is now of course shut off, save for small quantities which find their way into Germany via Sweden, or which were taken from craft captured in the Baltic. The Germans have been working on an "Ersatz" (substitute) for some time, and while it is not used generally as yet, engineers claim to obtain surprisingly fair results therefrom. They are, of course, very secretive about the matter; but from what the writer could learn, in a vague manner, here and there, it would seem that the substitute is an alloy of gold and a metal of the "radium" group, very likely uranium. Some experiments made with a selenium compound or rather alloy are also said to have been fairly satisfactory, except for the variable conductivity of this element which changes with the degree of light or radiation to which it is exposed; which fact caused fluctuations and disturbances throughout the ignition system of the car and led to the abandoning of the idea as hardly practicable.

One peculiar innovation was witnessed by me some time ago when visiting the Western front. It was a cylinder head made of a material which resembled wire-reinforced glass, and, it was stated, was indeed of a similar composition, namely, an oxide of silica made in one of the chemical factories along the Main and reinforced by a skeleton of steel wire. The valve seats, made of nickel steel, are put in place when the head is being made and still at a very high temperature. These cylinder heads are, except for the connecting ways to the manifolds, without jackets; small wire points protrude from the inner wire skeleton and are cooled by the stream of air directed upward by the inclined fan.

Wood Wheels Employed

While the French and English armies use thousands of cars fitted with wire wheels, the Germans have practically departed from their use, principally because the empire's enormous lumber reserves permit of easy and cheap wholesale production of good wooden wheels, while every metal is comparatively scarce and economy is necessary. The metal which has been less subject to this rule than any other seems to be aluminum, for which new uses are found every day and which is produced very cheaply by the electric furnace process.

Thermite Welding Process Important

The aluminum powder, or Thermite, process of welding has also become of tremendous importance, and the equipment for this process forms part of every "Automobil-Hilfe-Automobil," that is, an automobile containing the repairshop equipment needed for quick repairs of automobiles and motor trucks. These traveling "Automobillazaretts" contain a simple but complete outfit for welding, a lathe, punch, a small drop forge, and a full set of minor tools, so that almost any repair can be made anywhere and at any time, the necessary power being furnished by the motor of the repair wagon. These traveling repairshops are, morever, fitted with wireless telephones and small generators geared to their motors, so that they can easily and immediately get into communication with the nearest motor department, "Kraftwagenfluegel," of the army to which they belong. The crew consists of three men, each one an expert driver and mechanic and electrician.

Young Drivers Well Trained

Every kind of labor which is connected with the driving and repairing of automobiles is plentifully supplied to the army. The boys between 17 and 19 years of age are trained in the school, with a view to preparing them for military service when they reach the full age, and from among those showing mechanical ability and inclination the future automobile operators are picked. These are trained by experts, not only in driving, but in repairing every conceivable kind of accident or damage, as well as first aid to the injured; so that in all likelihood Germany will possess, when the war is over, the greatest number of automobile expert drivers among all countries in Europe, which will make these young men vastly superior in earning power and serviceableness to what they would have been without this training.

Automobile Corps of High Class

Wherever possible, the automobile drivers are chosen from the soldiers knowing the language of the enemy the particular army is in contact with, so that if by accident they come into possession of military information they are in a position to report it with the greatest possible speed to their superiors. A stranger would be most surprised to note the high percentage of intellectual men, engineers as well as students of medicine, languages and theology, among the contingent of automobiles attached to the German army.

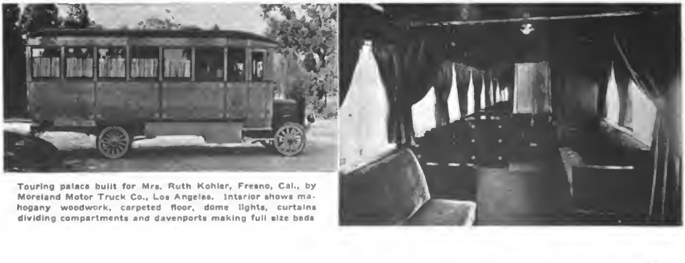
Spring Starters Widely Used

While the construction of automobiles, as heretofore mentioned, has become much simpler, no desirable accessories are spared to make operation efficient. For instance, spring types of self-starters are almost universally used where hand cranking is not retained; and speedometer, thermometer and barometer form part of every automobile equipment; the same thing may be said to hold true of the "trench periscope," a vertical tube with inclined mirrors at each end, and about 6 ft. long; a small heliograph, detailed map, compass, etc.

A Big Tractor Market

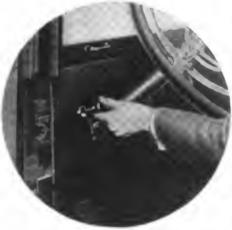
There is no doubt that when the war will be over, the automobile industry of Germany will emerge as something reborn and as far advanced over what it was before July 31, 1914, as it was at the latter date over 1900, both because of the improvements and developments made during the war, and on account of the practical annihilation of most draft animals, except what specimens were reserved for stock breeding. But there is little likelihood of the German peasant ever turning to horses again for his agricultural work. What he will look for, will be a moderately priced, highly reliable, simple, efficient automobile, which can be rapidly transformed into a tractor. For such a machine, Germany will offer a wonderful market, because, in spite of the empire's enormous industry, agriculture is still one of the two greatest, if not the greatest method of occupation of the German people.

Touring Land Yacht on a Moreland Chassis

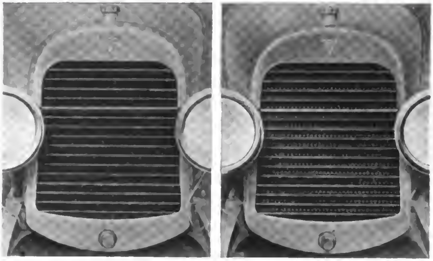


Touring palace built for Mrs. Ruth Kohler, Fresno, Cal., by Moreland Motor Truck Co., Los Angeles. Interior shows mahogany woodwork, carpeted floor, dome lights, curtains dividing compartments and davenports making full size beds

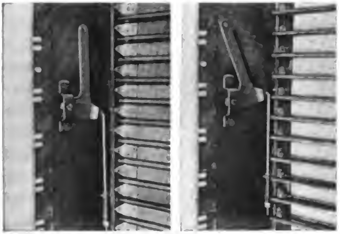
Hudson Fits Dash Radiator Control



Illustrating operation of the Hudson radiator shutter control by means of pull rod from the dash



At the left is a view of the Hudson radiator with the shutter closed and at the right with the shutter partly open



Left—Closed position of shutter link. Right—Open position

TO remove the necessity for using padded covers, etc., on the radiators of Hudson cars, the company has brought out a device which acts as a radiator shutter and which is being listed as special equipment. The new device is operated from the dash by the driver and permits him, by means of a simple plunger, to govern the amount of air that comes in contact with the radiating surface, and hence puts the temperature of the cooling fluid under his control.

The device acts very much as a shutter, with a series of vanes which open and close in accordance with the movement of the controlling device on the dash. In summer the mechanism need not be detached, as it does not cut down materially the area of the radiator when it is full open, so that in warm weather it is simply left untouched.

In order that the device will be complete, it is necessary for the driver to know the temperature of the cooling water accurately enough to determine whether the shutter is open or closed to the correct degree. This part of the equipment is provided by a Boyce Moto-Meter mounted in its customary position on the radiator cap.

The device is valuable in warming the car in very cold weather, as the air can be entirely shut off from the radiator until the water temperature reaches its efficient temperature, which in the case of the Hudson is stated to be 130 deg. Fahr. The shutter vanes can then be opened to the desired amount by simply operating the pull-rod on the dash.

From a maintenance standpoint the device is simple, as there is nothing to it except the shutter and the rod and bell-crank operating mechanism. There is no need for any adjustments, and none is provided. The installation is simple, and is made possible by using a longer radiator shell which not only houses the radiator, but also the shutter. It can be fitted to all Super-six Hudsons, the cost of installation being $25, with Moto-Meter complete. If the owner has already a Moto-Meter the shutter assembly costs only $15.

The accompanying illustrations give a very clear idea of the construction and operation of the device, the neat and simple pull rod mounting on the dash being both conveniently situated and by no means detrimental to the appearance of the instrument board. The front views of the radiator showing the shutter both closed and in a partly open position make it evident that appearance has not suffered in this direction; in fact, if any comment is to be made on the matter, it may be said that the new design is more attractive than the old and far less likely to become clogged with dust and debris from the road.

Goodyear Employees Paid for Ideas

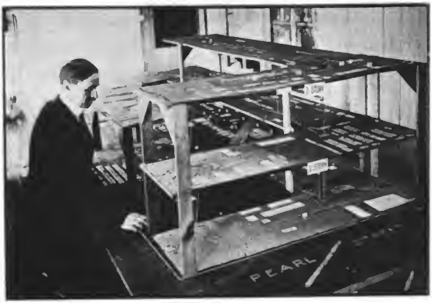
ONE of the most popular operative features at the plant of The Goodyear Tire & Rubber Co., Akron, Ohio, is the suggestion system, which enables employees to capitalize their ideas for improving machinery, conditions, methods and product.

The workmen who make Goodyear products are given every opportunity to advance their ideas, and all suggestions adopted are well paid for. Interest in the system is well sustained, and thousands of dollars have been paid to employees for their ideas.

The suggestion box method is used, with boxes placed throughout the plant in convenient places. Employees are asked to put their ideas in writing and deposit them in the suggestion box. The suggestions are gathered each day and referred to the proper persons for consideration. All are carefully gone over, however inconsequential they may seem.

Motion Study as a Production Factor

Examining the Worker's Motions To Ascertain Causes for Inefficiency—Frank B. Gilbreth's Methods and Instruments



Model of factory as laid out before plans for analysis are made to determine lost motion

DOES the average worker become fatigued unnecessarily? Is the production of the usual factory below its capacity? Are many factories increasing the number of men and the amount of floorspace needlessly? Is it possible for the average workman to be raised to a higher level of efficiency, raising his productive abilities, yet lowering his fatigue? Do wasted motion and wasted effort cause a vast loss of wasted time to the majority of manufacturers? These interesting and vitally important questions form a great part in the study of motion that Frank B. Gilbreth, efficiency engineer of Providence, R. I., has made a life problem and to which he introduced many novel and consequential theories and devices.

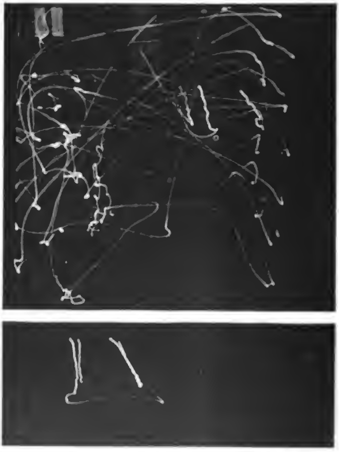
Wasted Energy

Thirty years ago Mr. Gilbreth was an apprentice bricklayer. He asked the foreman to show him the proper way to lay bricks. Though a master mason, the foreman had many methods. One was for hurried labor, another for times when speed was not required and so forth. The boy studied the work thoroughly. He saw that many of the men, like the foreman, never laid the bricks with the same motions for two jobs. He became convinced that a very valuable study would be found in an attempt to determine the least number of motions for brick laying that would at the same time have the effect of not tiring the worker. Since that time he has devoted himself to efficiency, first as a student, and now as a consulting engineer confining his time to the discovery of waste motion in various factories and industries.

He investigates factories, makes improvements, omits stages of manufacture and substitutes skilled labor for unskilled wherever possible. In a handkerchief factory he noticed one girl whose work, consisting of folding handkerchiefs, slackened perceptibly each afternoon until it fell far below the work of the others. Investigation revealed that the chair upon which the girl sat had worn, that the front legs were so low that the girl was forced to use her arms at so high an angle that they tired and consequently became less efficient. A carpenter repaired the chair and a few days sufficed to show the girl working with all the speed of her companions in the shop.

Motion Study a Science

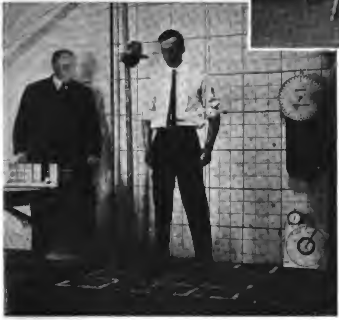
Mr. Gilbreth defines his work as motion study and says: "Motion study is the science of determining methods of least waste and my work is the installation of laboratories for large concerns and the creation of examining processes to determine how the work can be done with the least number of movements. The discovery of such a method allows the manufacturer to secure the greatest possible output, to pay his employees more money and to make more money for himself." He believes that



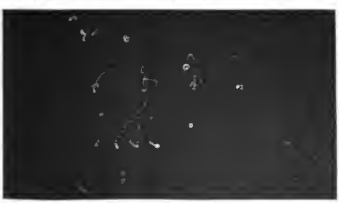
Above—Motions of a worker in loading sixteen boxes before motion study methods were adopted. Below—The same operation when efficient methods of concentrated motion are used

Right—Foremen of a factory being instructed in the wrong and right methods of operation by means of moving picture application of motion study

Below—Cross section method of studying motion to eliminate fatigue, the worker standing before a background of checks, so that each motion can be recorded according to its appearance before the squares



Lamp used with cinematograph to display the motions of the worker. Lamps are attached to fingers, knees or forehead



Hand of a bricklayer photographed with lamp attached and showing the operation of laying bricks when motion study methods minimize the expenditure of effort

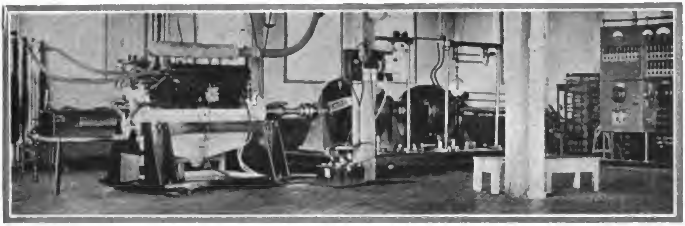
the only way to study an industry or trade is to learn the fundamental motions and to do these rapidly even though the speed, at first, affects the quality as he finds that the elimination of unnecessary motion is more important than spending time learning the process by slow and elaborate methods. The slow way, he states, requires far different motions from the quickest way and as a consequence, the worker is forced to learn two methods before he becomes proficient.

To ascertain the motions of workers, Mr. Gilbreth has utilized and invented many instruments. He commenced his work with a stop watch but found it too slow and often inaccurate and has combined with it the cinematograph, which is able to photograph every motion and preserve it and, in addition, when used with a special clock, allows him to time each movement. The clock is an appliance that makes a complete revolution every 3 sec. and measures to the millionth part of an hour. It has a watch attachment to check its accuracy. Temperature and humidity are always taken into consideration. A penetrating screen is used on which the proper motions are marked and before which a photograph of the worker is taken so that his movements can be compared with the correct ones. Thus, by means of the moving pictures and the screen, the worker not only sees himself as others see him but also is able to witness many movements not ordinarily seen by the eye and is shown all of the wasted effort he has used.

Lights Show Motions

To facilitate the camera, lights, similar to those used by physicians for examination of the throat and operated by a make and break apparatus, are used. They are placed upon the hands, fingers, knees and foreheads of workers and photographs taken reveal each movement of the various lamps. The photography is consequently utilized to determine time when compared with the clock and the flashing lamps, and to discover the width, length and breadth of the motion of the worker. Complete assembly operations are often photographed and each movement required by the different workers is displayed and timed and measured. The work of the best men can thus be shown on a slow moving cinematograph machine so that it can be followed by the unskilled and adopted by them.

Another instrument used is a background of checks against which the worker stands and moves so that each motion can be recorded according to its appearance before the squares. Utilizing this system, Mr. Gilbreth checked a man loading boxes. He classified his motions by sixteen acts under the headings of search, find, select, grasp, position, assemble, use, disassemble, inspect, loaded, position for next operation, relieve load, transport empty, wait unavoidable, wait avoidable and rest. The results of these checks are shown in the two illustrations at the bottom of the opposite page.



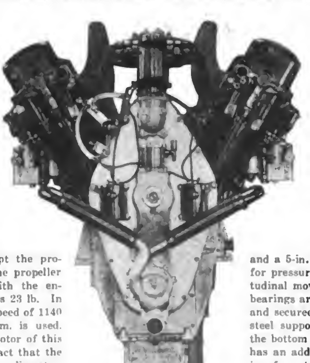
Knox twelve-cylinder aviation engine designed by F. H. Trego undergoing tests with a Sprague dynamometer at the Knox laboratory

Knox Aviation Twelve Tested

300-Hp. Engine Designed by F. H. Trego Has 4 3/4 by 7 In. Bore and Stroke—8-Hr. Run Made

SPRINGFIELD, Mass. Nov. 15—One of the largest V-type aviation engines ever built in this country has just been put through a series of tests in the laboratory of the Knox Motors Co. here by Frank H. Trego, chief engineer and designer of the motor. The engine is intended for high-power aviation work and is rated at 300 hp. It has been designed to meet the severest aeroplane service in Europe, and since work was started on it a year ago representatives of foreign concerns have not only been watching its development but keeping very closely in touch with all engineering details. Engineer Trego has been working on the matter consistently for nearly a year and has now a power plant capable of withstanding the severity of 8-hr. tests.

The engine, a twelve-cylinder, V-type valve-in-the-head design, has the aluminum cylinder blocks formed in groups of three, and the two sets of threes mounted at 60 deg. to each other. The bore and stroke of 4¾ and 7 give a piston displacement of 1488.53 cu. in. With this piston displacement the weight complete with starting and lighting motor and generator, ignition equipment, exhaust pipes, and tachometer is 1400 lb. This weight includes everything except the propeller hub, which is a part of the propeller assembly, although furnished with the engine. The propeller hub weight is 23 lb. In the preliminary test a propeller speed of 1140 and a motor speed of 1600 r.p.m. is used. Some conception of the work a motor of this type has to do is shown by the fact that the four-bladed propeller, 14 ft. in diameter, turns at 1100 to 1200 r. p. m. In this range of speed the effort of the propeller blades to fly off the hub approximates 20 tons each and the propeller has a pushing power of 2000 lb., according to Engineer Trego.



End view of the new twelve-cylinder Knox aviation engine

The cylinder blocks are aluminum castings open at each end and in these are pressed ⅛-in. cast iron liners, these liners having a flange on the lower end are pressed into the bottom. Although the cylinders are cast in blocks of three, the heads are cast in blocks of six and are of aluminum alloy with cast iron valve seats, cast integrally with head casting. The head for each of the cylinders is secured by sixteen nickel steel studs passing through the head. The four valves in each cylinder are carried in the head and the water-jacketing so arranged as to surround each valve seat. The water-jacketing of the cylinder blocks is so carried out as to extend below the bottom of the stroke and to allow ½-in. water space between adjacent cylinders. In addition each cylinder head has an aluminum cover which entirely conceals and protects all of the valve mechanisms.

The rotating and reciprocating parts of the engine have been designed with the thought of enduring the heaviest service imposed on an aviation motor. The crankshaft, a chrome nickel steel forging, is 3 in. in diameter at its three bearings as well as at the crankpins. The shaft has a total bearing length of 13 in., 4 in. at the front and center, and a 5-in. bearing at the rear. It is drilled for pressure lubrication and held from longitudinal movement by a center bearing. The bearings are babbitt, backed by a bronze shell and secured by aluminum caps backed up by steel supporting plates ⅝ in. thick all over the bottom of the bearing. The rear bearing has an additional supporting steel bar hanging from two bolts which pass down from a bridge over the top of the crankcase.

The pistons of special aluminum alloy carry three rings and have the piston pin held in the upper end of the connecting-rod with its bearing in the piston where the aluminum alloy serves as a bearing metal.

Connecting-rods are drop forgings with a bearing cap at the lower end held by two bolts and with cap and rod locked together by tongue-and-groove formation to prevent twisting The rods are side by side on each crank throw.

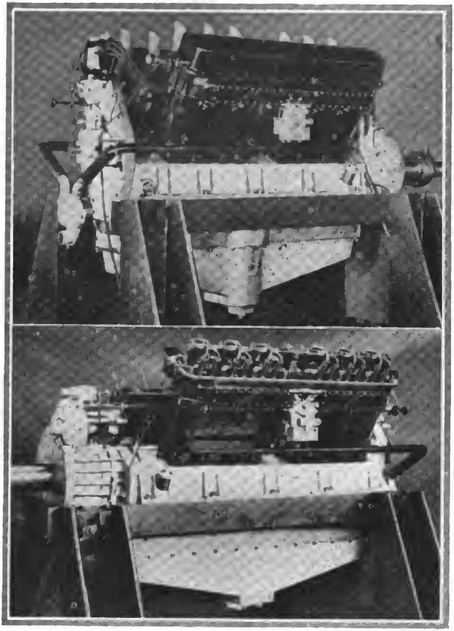
The crankcase is an aluminum alloy formed in one piece and extending 7 in. below the center lines of crankshaft in order to give a barrel section for strength. The lower half is a one-piece aluminum casting bolting to the upper half and not containing any of the motor mechanism.

For attachment into the framework of the aeroplane supporting legs are not used but support is through a shelf extending the full length of the crankcase on each side and on which the motor rests. Five bolts anchor each shelf into the framework of the aeroplane and to add rigidity a rib is cast on each side of each bolt. With this support the motor is kept very narrow at this point and rests in a frame 15 in. wide inside and with bolt centers 17 in. apart.

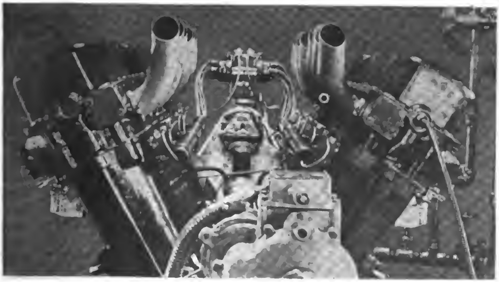
Valves at an Angle

The valve mechanism operating four valves in each cylinder is operated through a camshaft lying along the head of each cylinder block, thus mounting the valves at a slight angle to the cylinder bore. The camshaft and rocker arms are supported in the head, the camshaft having eight bearings. The arc-shaped rocker arms are supported above it as the end section shows. Forced feed lubrication with necessary drainage back to the crankcase is at the center of the motor when the motor is in normal condition and at each end when the motor tips up or down.

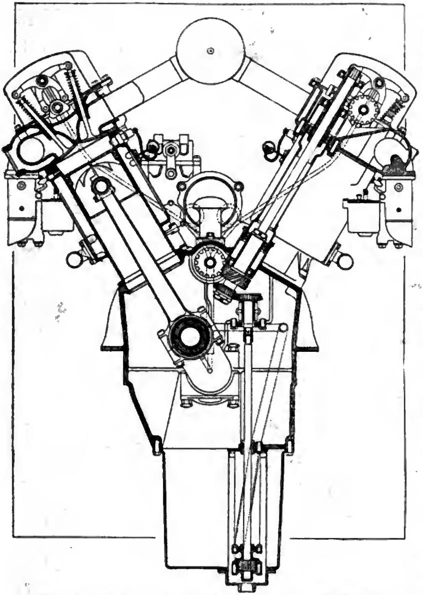
On one end of the engine is an



Above — Both sides of the Knox aviation engine, the upper one showing the arrangement of the ignition and water pump below. The lower picture shows the starting motor with its switch mounted immediately above a casing which contains the reduction gear for driving the propeller



Left—Looking along the V space between the cylinders showing the open exhausts, central location of the ignition unit and starting motor switch in front



Section through the Knox twelve-cylinder 4¾ by 7 in. aviation engine, showing the camshaft drive for the overhead valve rockers. The pump drive is also shown

aluminum housing for the timing gears and the support of the water pump, air pump, ignition apparatus and lighting generator.

On the other end of the motor is a heavy special aluminum casting to support the propeller shaft with its bearings in which the ball bearing holes are lined with steel bushing to prevent wearing the aluminum. This casting with its cover provides for the large starting gear on the propeller shaft as well as for supports for the starting motor, switch, etc.

Drive of Engine Accessories

The method of driving the different motor accessories is through a longitudinal drive shaft above the crankshaft and driven by the timing gears. This drive shaft has two integral spiral gears which are at the center of the motor for driving two vertical shafts, which extend up through tubes into the cylinder heads and on through short hollow shafts. Each vertical shaft terminates in a splined end with a splined cap piece which bolts to the short hollow shaft. This arrangement permits of changing the relationship of the camshaft to the vertical shaft for valve timing. The oil drainage from the cylinder head passes down through the ball bearings on the vertical shaft and thence through the tubes to the crankcase.

Motor lubrication embraces all of the moving parts of the engine. Oil flow originates in a pump supported from the upper half of the crankcase so that there is no pump connection between the pump and the motor. Steel pipes cast integrally with the crankcase register with the oil pump to make the necessary connections. Oil holes drilled in the case for lubrication are lined with steel tubes to insure against leakage. The main oil lead extends the entire length of the crankcase and has holes drilled to the crankshaft bearings, these also being steel lined.

The oil is taken in the crankshaft bearing at the timing gear and led to the horizontal driveshaft bearing immediately above it, and thence is led through the hollow driveshaft to the center or either end of the shaft, whence it flows through copper tubes to the cylinder heads. In each head it passes through the camshaft supporting brackets into the hollow camshaft, thence to all its bearings and to the hollow rocker arm shafts and to each rocker arm. The result of this oil circulation is that valve-stems, springs, rocker arms, rollers, camshafts and other moving parts are saturated at all times.

Timing gears are oiled by the throw-off of the crankshaft bearing at that end. The propeller gears are oiled in the same manner at the other end. Oil pressure is from 40 to 70 lb., there being an adjustable regulator on the side of the tank. A large oil screen is carried in the lower half of the crankcase and covers the oil pump clear up to the upper half of the case. This screen may be withdrawn for cleaning without disturbing any mechanism. On the outside of the crankcase is an oil gage.

Double Zenith carbureters are placed in each side of the engine, outside of the cylinder blocks, thus using a separate carbureter for each three cylinders. There is nothing on the outside of the engine excepting these carbureters; and there is nothing in the V between the blocks excepting the two breathers rising from the top of the crankcase.

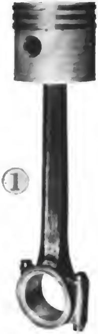
The electric starting motor and the lighting generator are built into the engine, the former so that starting is by pressing a button which throws the switch.

Ignition is by battery type with the current furnished by a battery for starting, but with the running current from the generator. There is one spark plug in each cylinder. All six priming cocks on each side of the motor can be operated at once by a pull-handle. Gasoline feed is by pressure furnished by a two-cycle type of air pump furnishing pressure of 4 to 7 lb. An adjustable regulator is attached.

The water pump, a double impeller type, with water on each side of the impeller to avoid thrust, is made in one assembly and driven through a flexible coupling at the end of the crankshaft. The pump has one intake and two discharge pipes, which lead to brass taper tubes extending alongside of the engine on either side, and supplying the cylinder blocks with water at two points each. The water rises through the cylinder jackets, passing directly into the heads through registering holes and flows out at either end of the heads as desired.

The propeller shaft is supported on a heavy double-row, self-aligning, ball bearing, with a thrust taken in either direction by a double ball thrust, with a load capacity of 2650 lb. in either direction. The propeller shaft is 3⅝ in.

(*Continued on page* 862)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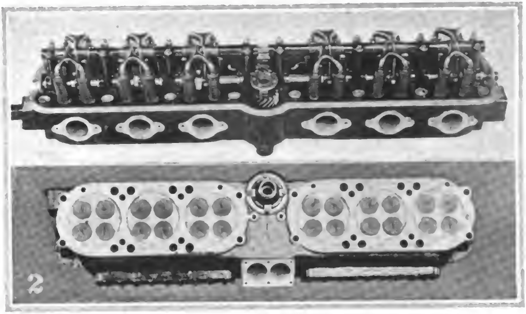
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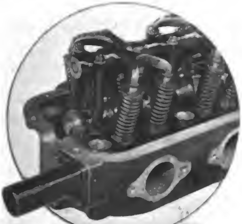
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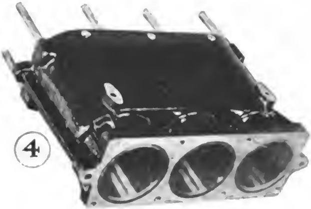
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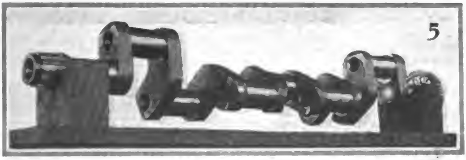
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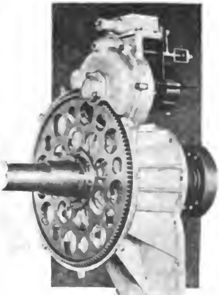
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1—The aluminum alloy piston is provided with three rings and a series of small oil holes is drilled through it below the lowest ring groove. The connecting-rod is a drop forging

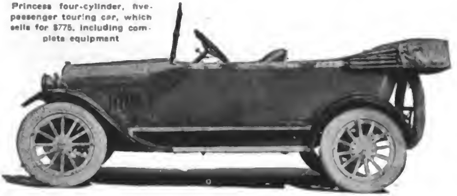
2—Two views of the cylinder head, which is of aluminum alloy cast in one piece with cast-iron valve seats. Note the four valves in each cylinder

3—Detail of the valve rockers which operate from a camshaft located immediately above the cylinder heads

4—The aluminum cylinders are cast in blocks of three and have cast-iron liners pressed in place

5—The crankshaft is a chrome-nickel forging 3 in. in diameter and has large bearing surfaces

6—Mounting of the starting motor, which has a single reduction gear to the crankshaft



Princess four-cylinder, five-passenger touring car, which sells for $775, including complete equipment

1917 Princess Is Larger

Wheelbase Increased 4 in.—Rear Axle Now Floating—Two-Unit Electric System

FOR 1917 the Princess Motor Car Corp. of Detroit is presenting a very much refined product as compared with the previous model. The factory is now pushing production and deliveries.

The car is larger, roomier and better equipped. The wheelbase has been increased from 104 to 108 in. the additional 4 in. being used for body space. This is the main factor in making the car larger and the difference is immediately apparent when last year's car and this year's are side by side.

Floating Rear Axle

In addition there have been numerous mechanical alterations. The rear axle design is entirely different, being floating instead of semi-floating. The starting and lighting system is a two-unit device instead of a single-unit one. It is Disco, as formerly. With the new installation a Bendix gear is used for the starting motor whereas the motor-generator outfit previously used had a silent chain reduction of 3 to 1.

To take care of the larger car, bigger brakes are installed. they are 12 by 2¼ in., instead of 12 by 1¾. The tires are larger, being 32 by 3½ instead of 30 by 3½.

In the engine no changes of importance are made although there are perhaps a dozen alterations of minor consequence. The position of the magneto is new, and the oiling system changed in detail. This is a detachable head unit.

The speedometer drive is from the transmission gears. Appearance has also been given attention in other details, particularly in the overhauling of the fenders and running boards. The running boards are now linoleum on wood, aluminum-bound, instead of aluminum on sheet metal. This is better construction right through, and besides being more sightly it is also stronger and does away with rattles. The front fenders are so formed that they are virtually sill boards also, this removes all the cracks and prevents the entrance of any dirt or water.

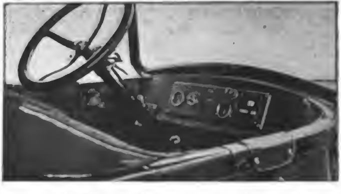
A sloping windshield instead of a vertical one makes not only for appearance but also for strength in taking the strains imposed by the one-person top. The side curtains are now easier to adjust.

On the instrument board the Van Sicklen speedometer, speedometer light, ammeter, oil gage, King lock, and fuse box with spring-attached cover, are grouped integrally. By taking out four screws the entire instrument assembly can be lifted out for repair or inspection.

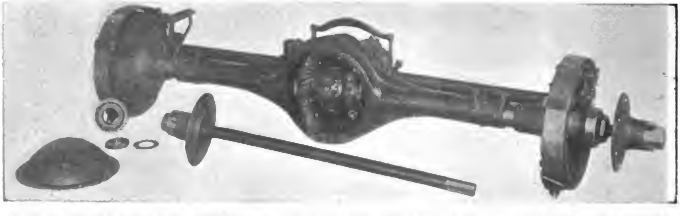
Unit Power Plant

The engine is a unit with the clutch and gearset, and is a four-cylinder, L-head block design with valves on the left. The cylinder dimensions are 3¾ by 4¼ in., giving a formula rating of 22.5 hp., and a piston displacement of 187.9 cu. in.

Conventional practice is followed in the engine design. It is a three-bearing crankshaft type. The valves are com-



Driver's compartment and new metal instrument board on the 1917 Princess. All wiring is integral. Board is of dull black enamel with instructions of nickel set flush



Floating rear axle design used in the 1917 Princess, supplanting a semi-floating construction in the previous model. Housing is of pressed steel and a four-pinion differential is used with six-spline side gears posite, having cast-iron heads and nickel steel stems, and have an opening in the clear of 1⅝ in. and a lift of 7/37 in. The outside diameter is 1 13/16. They are adjustable by removing the side plates and turning a nut on the end of the push rod.

The silent chain drive for the timing gears and magneto runs in oil and has provision for adjustment. The lighting generator is also driven by silent chain.

Materials Standard

As far as materials are concerned, the engine is in line with usual practice, the connecting-rods being 0.30 to 0.36 carbon steel, drop forged and heat treated, the crankshafts are 0.35 to 0.40 carbon steel, and the cylinders and pistons of cast gray iron. The detachable cylinder head, is also of cast gray iron.

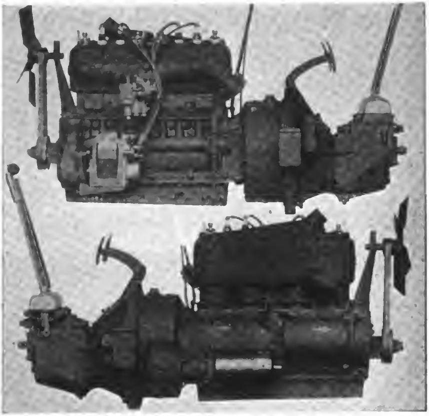
Oil is delivered by plunger pump driven from the No. 4 exhaust cam, to a dash sight feed and thence to the main bearings and thence to the splash troughs where the cylinders and other internal engine bearings are taken care of by the dip of the rods. The silent chain drive for the auxiliary devices is also cared for in this system by a separate lead which keeps the chain submerged in lubricant.

Ignition is by a Splitdorf Dixie type of magneto and carburetion by a Schebler.

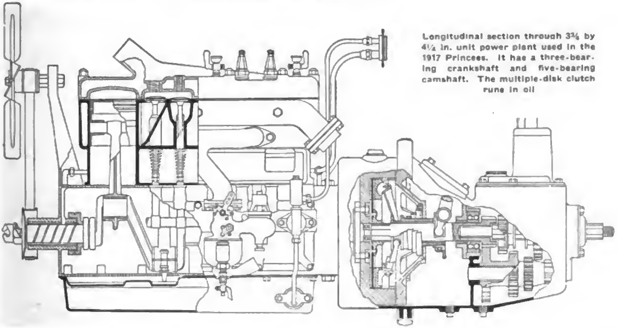
From the engine the drive is transmitted through a single steel dry-plate clutch to the Grant-Lees three-speed gearbox. The drive is the customary shaft with two universals. The rear axle is floating and the rear springs are three-quarter with the main leaf of vanadium steel. A guarantee against breakage of the main leaf is given for 2 years. The wheels are of hickory fitted in the rear with the 12-in. brake drums. The service brake is external contracting and emergency internal expanding on rear wheel drums, as shown in the view of the axle on page 860.

The new floating rear axle is amply strong, the housing being of pressed steel with a double lap on the differential housing; wall thickness is 5/32 in. A four-pinion differential is employed with six-spline side gears, gear ratio being 4 to 1, with twelve-tooth pinion and the gears are spirally cut. There is an independent adjustment on the bearings. Axle shafts are heat-treated chrome-nickel steel and 1¼ in. in diameter. Spokes are 1⅜ in. in diameter.

Fully equipped the car sells for $775, f.o.b. Detroit. The standard equipment includes electric starting and lighting, speedometer, Neverleak one-man top, two-piece, rain-vision windshield, two electric lights with dimmer, dash lamp, number bracket, robe rail, tire holder, extra rim, tool kit and electric horn.



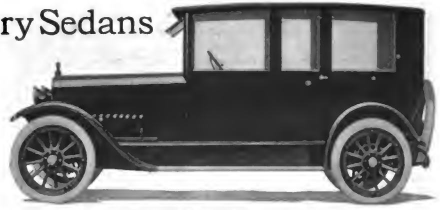
Both sides of the four-cylinder L-head unit power plant used in the 1917 Princess. The engine has a bore of 3¾ and a stroke of 4¼ in., giving a piston displacement of 187.9 cu. in. and a formula rating of 22.5 hp.



Longitudinal section through 3¾ by 4¼ in. unit power plant used in the 1917 Princess. It has a three-bearing crankshaft and five-bearing camshaft. The multiple-disk clutch runs in oil

Two New Jeffery Sedans

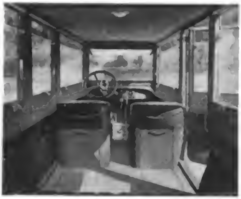
Four and Six-Cylinder Types with Removable Tops for Summer Touring Brought Out By Nash Motors Co.



New seven-passenger sedan body mounted on Jeffery six-cylinder chassis and selling for $1,530. The extreme simplicity and severe lines are characteristic of the design. Note how closely the fenders follow the wheel contours

AS announced recently in the news columns of THE AUTOMOBILE, the Nash Motors Co., Kenosha, Wis., has brought out two new sedan models to meet the increasing demand for inclosed cars for Winter service. The new bodies, however, which are mounted on both the four- and the six-cylinder chassis, have removable tops which widen the scope of their usefulness throughout all seasons of the year. Both models have seating accommodations for seven passengers, the two folding seats being neatly concealed when not in use in the backs of the front seats, which are divided, as shown at the right.

The four-cylinder Jeffery chassis has a wheelbase of 116 in. and the block engine is 3¾ by 5¼. A three-speed-and-reverse gearset is used in connection with a disk clutch and semi-floating axle. The six has a 125 in. wheelbase and the engine is 3½ by 4⅝. Rear axle is semi-floating.



Interior of the new Jeffery sedan body, showing the divided front seats, wide door and dome light in the ceiling

Both bodies are two-door constructions, a feature which enabled the designers to provide unusually wide doors, while the aisle between the front seats, which makes this arrangement possible is of ample width to permit the passage of the occupants of the front seats to the rear and *vice versa* without inconvenience. Like the doors, the windows, which are of the French plate type, are of noticeably liberal dimensions, the rear window being 31 in. wide and 19½ in. in height. These windows drop 5 in. to give adequate ventilation in warm weather, providing a good circulation of air without permitting a draft on the heads of the passengers.

Upholstery is of gray whipcord and roll curtains on the windows, with numerous other touches of luxurious refinement aid the work of the Nash engineers in giving the new sedans all the comforts of a standard high-priced limousine. To insure entirely weatherproof qualities in the top, in all conditions of wind, rain, snow or sleet, a series of painstaking experiments were made. As a final touch, the large dome light in the center of the top was provided for light and warmth.

Knox Aviation Twelve Tested

(Continued from page 858)

diameter bored out to leave ⅛-in. wall. On this shaft is located the starting gear which through a train of gears connects with a starting motor by roller clutch.

Propeller Hub Mounting

The propeller end of the shaft is tapered to take the propeller hub which it drives through four heavy integral jaws. The propeller hub is drawn onto this shaft by right-hand nut and locked by a left-hand plug. The propeller hub with its inside flange is in one piece, incorporating the jaws to engage the corresponding jaws on the propeller shaft. The propeller hub is splined on the outboard end to take the splined flange, thus giving an allowable thickness of propeller of from 5 to 9 in. The propeller is clamped into place by eight bolts passing through both flanges. The propeller shaft, as well as the crankshaft at this end, is splined to take the propeller gears. Spline construction is very general throughout the motor.

Tachometer Driven from Camshaft

A tachometer is provided and driven from one end of the camshaft. It indicates propeller speed from 500 to 1500 r.p.m.

The horizontal driveshaft projects through the gearcase cover, so that the pulley may be added to drive a wireless generator if necessary.

At a test of this motor made at the Knox factory Saturday, Nov. 11, a run of 8 hr. was made. During the first 7 hr. the engine speed was from 1400 to 1600 r.p.m., pulling a load of 200 to 245 hp. For the last, or eighth, hour the speed was 1600 r.p.m., pulling a load of 300 hp. The average horsepower for the 8 hr. was 243, giving a total of 1948 hp. hr. with a gasoline consumption of 198.4 gal. This is 0.612 lb. per hp. hr., which could scarcely be taken as a fair test, as you cannot expect to get a true test with one-quarter and one-half throttle conditions.

No Air Blown on Plugs

After the test had been under way for 40 min. a stop of 2 min. was made to change a spark plug, but after this no spark plugs were changed and no air of any kind blown upon the plugs. The water temperature was 108 deg. Fahr. at the entrance and 140 Fahr. at the discharge. Air temperature was 62 Fahr. at the start and 78 Fahr. at the finish, in the testing room.

The test was made with a Sprague electric dynamometer, as shown in the illustration at the top of page 856.

Myle-Maker for Fords

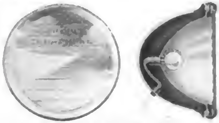
THE Myle-Maker is an automatic auxiliary air adjustment for the standard Ford carbureter. A pendulum valve, actuated by the incoming air, hangs in a housing bolted to the air intake. It is secured by a set-screw, and may be fastened on by the owner in a very short time. When starting and at low speeds the valve restricts the air supply and causes a rich mixture to be sent to the engine; but at high speeds it is swung open, admitting more air. It is claimed that the device gives an easy starting mixture, as well as an economical mixture at normal speeds. Price, $5.—Myle-Maker Co., 323 East Twenty-third Street, Chicago.

Corning Conaphore

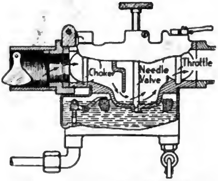
The Corning Conaphore is a device for preventing glare from headlights or spotlights. It is made either of yellow tinted glass, styled "Novoil," or of clear glass, having a smooth outer surface and a series of horizontal corrugations on the inner surface. These corrugations are said to bend the light rays down, until at no point are they more than 42 in. above the road. The yellow tinted glass is claimed to absorb the violet and blue rays, prevent glare, and transmit a ray that penetrates fog or dust. The sizes vary by ⅛ in. steps from 3 in. diameter to 11½ in. Price, Novoil, or yellow tinted glass, 3 to 4⅞ in., $1.30 per pair. Clear glass, 80 cents per pair. Other sizes in proportion.—E. A. Cassidy Co., 30 East Forty-second Street, New York.

Paramount Snubbers for Fords

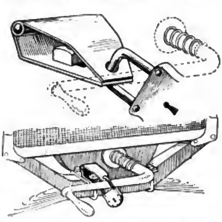
These snubbers retard the upward motion of the body when recovering from a shock. One is installed on each end of the rear spring and consists of a resilient compression spring anchored in castings that are held in place by two cantilever springs. A strong webbing strap which buckles around the axle is fastened to the casting at the top of the compression spring. The lower casting is attached to the car spring by means of a tie-plate and two bolts. The installation only requires that the snubber be bolted to the rear spring, and the strap fastened around the axle, all of which may be done by the owner in a few minutes. Price, $6.—Detroit Engineering Products Co., Detroit, Mich.



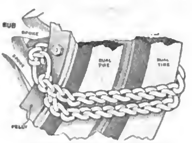
Corning Conaphore glare preventer venter



Myle-Maker air adjustment for Ford cars



Warner crank lock attached to Ford



Herman tire chain for trucks

Campbell radiator and hood cover

Warner Lock for Fords

The crank of the Ford is locked in mesh with the crankshaft and the motor may not be turned over until the lock is released. A hinged metal member is bolted over the front spring clip and carries a heavy padlock that permits the crank to be held in mesh with the crankshaft. Price, $1.50.—G. H. Warner Co., 318 Century Building, Indianapolis, Ind.

Campbell Radiator Cover

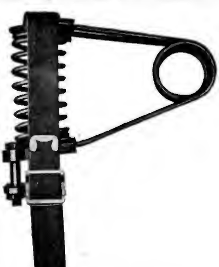
The unlined covers are made of waterproof fleece-lined material with adjustable doors. The two-ply is imitation leather, waterproof, and the outside is lined with kersey blanket material quilted. Price, Ford unlined radiator cover, $1.38; Ford unlined engine cover, $1.14; Ford lined two-ply radiator cover, $1.58; Ford lined two-ply engine cover, $1.46. All other cars in proportion.—Perkins-Campbell Co., 622 Broadway, Cincinnati, Ohio.

Herman Truck Tire Chains

This device provides increased traction by means of three double cross-chains locked to each of the rear wheels. Each cross-chain is double, hence smaller than the equivalent single chain and said to reduce vibration. Price, per set of six double chains, 3 to 3½ in., $5; 4 to 4½ in., $6.50. Dual tires, 5 in., $13; 6 in., $15; 7 in., $17.—Herman Mfg. Co., 1420 Pennsylvania Avenue, Washington, D. C.

Allen Gloves

These are heavy, warm gloves for automobiling in winter. Over a detachable



Paramount snubber for Ford cars

Genolite lighting system installed on a Ford engine

woolen glove is the leather glove proper, that may be worn separately if desired. These gloves are made in mitten, one-finger and glove shapes, finished either in black or tan leather. One of the many styles the company makes is illustrated herewith. They sell for $5 per pair.—Allen Glove Co., Gloversville, N. Y.

Stevens Valve Stem Reamer

By the use of the valve stem reamer guide and the special reamer, the worn valve guides of the Ford motor may be reamed 1/64 in. and fitted with the special valves having an oversized stem. The reamer guide is held in the valve seat by means of a clamp bolted in an adjacent cylinder-head bolt hole, holding the reamer in alignment and insuring an accurate job. The special valves supplied are of good quality, having the head electrically welded to the stem, which is 1/64 in. oversize. Price, valve stem reamer, $1.50; valve stem reamer guide, $1.50; oversize valves, 20 cents each.—Stevens & Co., 375 Broadway, New York.

Amazon Tire

The Amazon is a reinforced non-skid tire, as shown in the illustration. Just below the outer edges of the tread heavy breaker strips are placed above the fabric body. It is claimed that these strips absorb the shocks and strains that otherwise would be transmitted direct to the tire carcass, and thus increase the life of the tire. Price, 30 by 3½, $14.75; 32 by 3½, $17; 34 by 4, $24.50, and 36 by 4½, $35.50.—Amazon Tire & Rubber Co., Akron, Ohio.

Genolite Lighting System

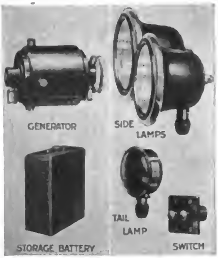
This lighting system for Ford cars includes a 2-volt generator, a single-cell storage battery, two side lights, a tail light and a switch, together with all brackets and wiring necessary to make the installation. The generator is mounted on a bracket secured by the two hose-coupling bolts to the forward end of the motor. The cut-out mounted on this bracket automatically connects and disconnects the generator and the battery at the varying engine speeds. The generator is driven by a spiral wire belt from a split pulley attached to the fan. The wiring is of the grounded system, the wires being of various colors and properly labeled to eliminate wrong connections. The battery is of 40-amp.-hr. capacity and guaranteed for 15 months. The generator will generate from 8 to 10 watts, and is said to be more than ample to take care of the complete lamp load. No machine work is required in the installation, and it is claimed that the work may be done in 2 hr. Price, $19.85, f.o.b. Detroit.—Detroit Starter Co., Detroit, Mich.

P. D. Q. Spark Plug

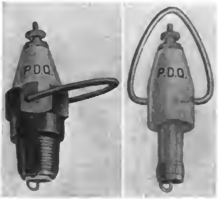
The P. D. Q. is a two-pieced plug having a detachable porcelain. The union between the porcelain and the shell is made tight by accurately machining the joint, and is held by means of a bayonet catch. The construction is claimed to be durable, to permit easy inspection and cleaning, and to offer a ready means of priming. The plug is made either with the ½-in. standard S. A. E. or metric thread. Price, $1; extra porcelain, 75 cents.—Wolverine Spark Plug Co., Detroit.

Universal Master Wrench

A new principle is employed in this wrench, which may be used for turning square or hexagonal nuts, or for pipe. It has a non-adjustable V-shaped jaw, one side of which has fine, sharp teeth and the other is provided with a transverse V-block which slides on this member of the jaw. This block is so shaped that it will receive a square nut, a hexagonal nut or a pipe or rod and as soon as pressure is applied to the handle, will jam the work firmly against the other jaw. Quick adjustment is provided because it is only necessary to move the V-block along the jaw and there is nothing to hinder this motion.—Shepard-Prince Co., 18 East Forty-first St., New York City

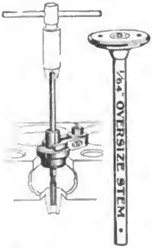


Genolite lighting system complete outfit



P. D. Q. spark plug which operates on the bayonet lock principle to simplify cleaning and priming

Allen gloves are made in several styles. This has a detachable inner glove



Stevens valve stem reamer for Fords

A section of the Amazon reinforced non-skid tire, showing strong inner structure

Industrial Miscellany

Factory

Goodyear Tire & Rubber Co., Akron, Ohio, has leased 10,000 acres of cotton and near Chandler, Tex., and has engaged E. W. Hudson, formerly government cotton expert, to take charge of the plantation. The company will engage in the raising of long staple Egyptian cotton for the manufacture of automobile tires, it is stated.

Shortage of skilled labor grows more acute each day, and the condition is general throughout Wisconsin. The motor car and truck industry is feeling the result. The Four Wheel Drive Auto Co., Clintonville, Wis., is advertising heavily in Milwaukee and Chicago newspapers for fifty turret and engine lathe, milling machine and drill press operators; ten bench hands; ten assemblers, and two inspectors, but has been able to get only a very small number of men. From 800 to 1200 skilled machinists would be given immediate employment if they were available.

At the present rate of rubber plant growth and activity in Akron it looks as if 15,000 more men would be needed in that city by March of the coming year.

The Firestone Tire & Rubber Co. is now employing 7000 men as against 3500 last year. This company now has four new buildings under construction, Goodyear has eleven, Goodrich five, and Miller two.

The Miller company used to employ 500 men. It now has 1750 on its payroll. The Goodrich factory, biggest of all, now has 14,000 employees and is unable to obtain the 2000 additional which are needed.

Production at the plant of the Westcott Motor Car Co., Springfield, Ohio, has increased about two and one-half times that of a year ago and a further increase is expected within the next half year. The present output is twenty-five cars a day.

Last July the factory was removed from Richmond, Ind., to its present location. The company was organized in Richmond in 1869 and became prominent as a manufacturer of horse-drawn vehicles. The increased demand for its automobile necessitated the removal to larger quarters, which are used entirely for the manufacture of the car.

The new plant consists of a three-story building, consisting of 176,000 sq. ft. of manufacturing space.

Macon Motor Car Sales Co., St. Louis, will be organized at once to sell The Macon, a car assembled at the factory of The All Steel Automobile Co., Macon, Mo. Salesrooms at 2206 Locust Street have been leased.

"Efficient Methods in Making Brake Lining Renewals" is the title of a folder recently issued by General Asbestos & Rubber Co., Charleston, S. C., manufacturer of the Garco brand of brake lining. This folder is written in plain, understandable style, and is designed to enable the inexperienced motorist to reline his brakes with perfect success.

Anger Engineering Co., 301-305 Sixteenth Street, Milwaukee, which manufactures the A. E. C. custom-built cars and operates a large service shop, has completed arrangements for the establishment of a large new plant at Twenty-sixth and State Streets, Milwaukee. The building will be of fireproof construction, 130 by 120 ft., one-story and basement, and contain the machine shop, factory, service shop and a public garage, together with offices and salesroom for the Ford agency recently acquired by the Anger company, and now conducted in separate quarters at 1517-1519 State Street.

Monarch Tractor Co., Chicago, has taken over the John Dornfeld Iron Works, Watertown, Wis., which in recent months have been devoted to the manufacture of farm tractors and sugar cane harvesting machinery. The Monarch company, a South Dakota corporation, is capitalized at $250,000 and now has more than $400,000 worth of orders booked. The tractor is styled the Never-Slip and is built in sizes from 6 to 60 hp. The 45-hp. type is used as the motive power of the Luce sugar cane harvester, an 11-ton machine which does the work of forty to sixty men on sugar plantations.

Maxwell Motor Co. at Kansas City, Mo., has already started work on the new assembling plant there, which will be ready for occupancy about the first of the year and which will cost $300,000. Bids are in for the erection of a large assembly plant at Windsor, Canada, where the Maxwell company plans to erect a building 100 by 300 ft., four stories high. It is planned to establish a chain of assembly plants throughout the country, and a site has already been secured at Minneapolis.

The Automobile Calendar

ASSOCIATIONS

Nov. 22—Boston, Mass., National Assn. of Automobile and Accessory Jobbers' Meeting.

Dec. 2-9—Electricians' Countrywide Celebration.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.

Nov. 16—New York City, S. A. E. Meeting.

Nov. 23—Philadelphia, Pa., S. A. E. Meeting.

Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.

Nov. 30—Uniontown, Pa., Speedway Race.

Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23—Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14—Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15—Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race, Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.

Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel I. R. Gates, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.

Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 23-27—Baltimore, Md., Show, Fifth Regiment Armory.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24—Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co., Armory of the University of Ill.

March 6-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade.

Personal

Charles Drum has been made the superintendent of production for the Springfield Body Co. Mr. Drum was formerly connected with the Haynes Mfg. Co.

The Springfield Body Co. will move to its new plant at Springwells, near Detroit, by Feb. 15 and will have a capacity of 100 bodies per day. At present the company has a capacity for thirty-five bodies daily.

Calvin Dunlap has become the vice-president of the International Commercial Corp. of New York. Mr. Dunlap was formerly the export manager for the Hupp Motor Car Co.

J. E. Turk, formerly connected with the Thomas B. Jeffery Co., Kenosha, Wis., has been appointed sales representative of the Chalmers Motor Corp. in Central West territory.

C. F. Barth has been appointed works manager for the C. F. Wilson Body Co. Mr. Barth was formerly the factory and production manager for the Murphy Chair Co.

A. E. Gluck, purchasing agent for the Packard Motor Car Co., New York City, has resigned. He has become president and general manager of the Abbott Motor Equipment Co., this city, distributor for the Warner lens, Block mirrorscopes, Amsco jacks and Twombly foot pumps. S. S. Frankenstyne remains as treasurer and sales manager. H. T. Stevenson succeeds Mr. Gluck as Packard purchasing agent, while W. C. Lyons takes up his work as head of the accessory department.

A. S. Gilchrist has been appointed manager of the Maxwell Motor Sales Corp., Baltimore, Md. He succeeds L. A. Tilley, who resigned. E. A. McKee, of the efficiency sales promotion department of the Maxwell company, has been attached to the local office indefinitely. Mr. Gilchrist is a former newspaper man, but has been with the Maxwell company for more than three years. He has been attached to the sales department and was also southwestern manager with headquarters at Houston, Tex.

J. R. Blocher, formerly branch manager of the Prest-O-Lite Co.. in Baltimore has been appointed division manager and will make his headquarters here. E. W. Carpenter, who has been with the company for a long time becomes branch manager in Baltimore.

J. A. Muir, who was with the D. E. Truck Co. in Baltimore and for a number of years with the Mar-Del-Mobile Co., Packard and Saxon agents, has been appointed sales manager of the Monumental Motor Car Co., Kisselkar representative.

A. E. Hertzig, manager of the Baltimore branch of the Goodyear Tire & Rubber Co., Akron, O., has been appointed manager of the Washington branch of the company and will take care of the territory in both sections. L. J. Gemmil, who was manager of the Washington branch will look after all of the government business exclusively.

E. T. Cole, manager of the Akron Tire & Rubber Co., Baltimore, Md., Ajax distributor, has taken the state agency for the Cleveland Standard Tire & Rubber Co. Charles E. Brooks will be in charge of the wholesale business throughout the state.

Harry Lowenstein has become manager of the R. M. Stein Co., Baltimore, Md. F. M. Sandy has become sales manager, and Charles Foutz, factory superintendent. The company operates two separate lines and handles the Moon and Ford.

A. E. Dixon has been made a member of the advertising department of the Chalmers Motor Co., Detroit. Before joining the staff of the Chalmers he was connected with the advertising departments of the Hupp Motor Car Corp. and the Packard Motor Car Co. Mr. Dixon will edit Chalmers Shop and Service, and will prepare pamphlets and other literature. The Chalmers Illustrated News has recently made its appearance.

A. H. Bailey has entered the Chemi Co., Richmond, Va., and has been elected vice-president.

M. A. Steele, late manager of the Henney Buggy and Stephens Motor branches of the Moline Plow Co., at Freeport, Ill., has been appointed general sales manager of the Stephens Motor branch with headquarters at Moline, Ill., H. J. Leonard, who has been assistant manager, succeeds Steele at Freeport.

F. C. Herschbach, of St. Louis, has resigned as assistant sales-manager for the Commercial Auto Body Co. of that city, for a similar position with the R. Haas Electric & Mfg. Co., Springfield, Ill.

G. O. Smalley has been elected first vice-president and general manager of the Bound Brook Oilless Bearing Co., Bound Brook, N. J. He succeeds the late Leigh Stanley Bache.

F. H. Whitman, formerly of Dodge Brothers, Detroit, has been appointed production engineer of the National Motor Vehicle Co., Indianapolis.

H. H. Brooks has been appointed superintendent of agencies at the Madison plant, Anderson, Ind. Brooks was one of the original incorporators of the Marathon Motor Works, Nashville, Tenn., where he served several years as sales and advertising manager. He was later connected with the Wayne Works, Richmond, Ind., and still later with R. A. Palmer in the Pontiac Chassis Co., Pontiac, Mich., in the same capacity.

Alvan T. Fuller, who handles the Packard line in Eastern New England from Portland, Me., to Providence, R. I., has been elected to Congress from Massachusetts. He entered the fight at the last minute as an independent against Congressman Ernest Roberts.

Dealer

Studebaker line has been dropped by the Corson-Berry Co., Springfield, Mass., and the Paige taken on its place. The Becker-Stutz Co., has taken on the Studebaker and moved to new salesrooms. W. F. Cassidy, who has the Grant Six, has moved into new quarters. The Western Massachusetts Longford Co. has shifted to 453 Worthington Street. The Harrington-Gifford Co. handling the Hudson Six, has also moved.

National Sales Co. has been organized at Providence, R. I., to handle the National line for Rhode Island.

Studebaker Corp., Worcester, Mass., has moved to temporary quarters on Main Street until its new building is finished.

Auto Trading Co., Pittsburgh, Pa., has taken over the Metz interests in that part of the State.

The Chevrolet Motor Co., of New York, has just opened a branch in Worcester, Mass.

The Springfield Body Co. has opened a branch at New York City in the Locomobile building, 16 West 61st Street, and has sent Charles Baasch on from the factory to take personal charge of it.

W. L. Patterson, St. Louis, has added Whitemore's automobile grease to the line handled by him at 3218 Locust Street.

Newsome Valve Co., St. Louis, has been organized to manufacture a tire tube invented by J. M. Newsome.

Auto-Devices Co., St. Louis, has taken the agency for the Hi-Comp piston ring. Salesrooms are at 3212-14 Locust Street.

Geller, Ward & Hasner Hardware Co., St. Louis, is territorial distributor of Prismolite lens.

Auto Sales Co., St. Louis, has removed into larger quarters at 908-10 Chestnut Street and becomes agent for the Wesco garage heating systems.

J. T. Conaghan has opened a garage and sales agency in Pekin, Ill., and will handle the Ford car, succeeding the Pinkerton Co., which retires from the Pekin field.

Bosch Magneto Co. has appointed the following new service stations: A. L. Ebbeson, Bangor, Me.; Auto Service Co., Bridgeport; Connel Wilson Electric Co., Jacksonville, Fla.; Harrington Motor Co., Mobile, Ala.; Garlock & Haynes, New London, Connel Auto Ignition Co., San Jose, Cal.; Essanell Electric Co., St. Paul; Tonopah Electric & Tire Co., Tonopah, Nev.; Tri-State Garage Co., Uniontown, Pa.; Tourist Garage & Motor Repair Co., Wilmington, Del.

Willys-Overland, Inc., selling organization has opened a direct branch at 33 Allyn Street Hartford, Conn., and succeeds in business The Overland-Hartford Co., at the corner of Allyn and High Streets. E. C. Bowman is manager of the new branch and associated with him is F. C. Brown, also a factory man. I. F. Maxson, manager of the Overland Hartford Co. will represent the Toledo factory in another capacity.

G. H. Grabb, Haynes and Auburn distributor, Hartford, Conn., has removed his salesroom to 289 High Street.

Keeney Truck Sales Co., 120 Allyn Street, Hartford, Conn., has taken over a portion of the Mattison building at the corner of Albany and Center Streets, and will use it as a service department for Selden and Vim commercial vehicles.

Adams-Bagnall Electric Co., Cleveland, Ohio, is now completing an addition to its factory with the installation of a complete vitreous or porcelain enameling plant.

Norton Monsarrat and **Captain I. I. Morrison** have organized the Stewart Motor Sales Co. for the purpose of handling Stewart trucks in central Ohio territory. They have opened sales room and a service station at 103 North Front Street, Columbus.

JOHNSON'S
GUARANTEED
CARBON REMOVER

Your Car Will Run Like It Did The First 500 Miles—

if you keep it free from carbon—the black plague of motorists. The quickest, easiest and cheapest way to remove carbon from your cylinders is with

JOHNSON'S CARBON REMOVER

Five minutes time and no labor required. Lift your hood and pour an ounce of Johnson's Carbon Remover in each cylinder through the petcocks or spark plug openings. Put down the hood—go to bed—get up in the morning and drive a perfectly clean engine. You can save from $3.00 to $5.00 over any other method without loss of time and with much better results.

SPECIAL OFFER

We will send you by prepaid express for $1.00 (bill or stamps) enough of Johnson's Guaranteed Carbon Remover to thoroughly clean any ordinary four-cylinder motor three times. Please give us the name of your dealer.

S. C. JOHNSON & SON, Dept. A, Racine, Wis.
(Patent Applied For)

Takes out that Knock
and
Puts new Life in Your Engine

When Your Dealer Recommends a Rayfield

Since the dealer must depend upon your good will for continued patronage, it is plainly a matter of good business for him to recommend that which will give you the utmost service and satisfaction. It is a question of efficiency and not of price.

RAYFIELD CARBURETORS

are the first and only recommendation of the dealer when there is a question of replacement.

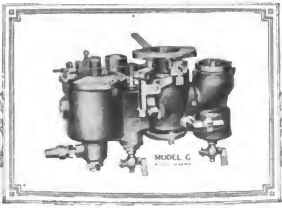
The reasons are obvious and generally known. While the Rayfield is highest in price, it is admittedly the most efficient and most economical. It gives greater mileage per gallon of gasoline—smoother action—quicker starting (summer or winter)—more power—and wider range with a standard adjustment. Our positive guarantee of performance leaves no room for doubt.

There are more than 600 Rayfield Service Stations in the principal cities and towns of America.

FINDEISEN & KROPF MFG. CO.
2117 Rockwell Street, Chicago

BRANCHES:
1140 Michigan Ave. Chicago
1902 Broadway New York
1191 Woodward Ave. Detroit

You have 30 days to prove Rayfield claims and privilege to return your Rayfield if not absolutely satisfactory to you.



HESS-BRIGHT

Not Controlled by Outsiders

To correct misleading rumors and statements The Hess-Bright Manufacturing Company makes the following announcement:

A group of bankers, including Frank A. Vanderlip, Philip W. Henry, Thatcher M. Brown and Franklin B. Kirkbride, of New York, and Marcus Wallenberg, of Stockholm, have recently acquired from the American group of stockholders a controlling interest in the shares of The Hess-Bright Manufacturing Company. This group of bankers owns also a substantial interest in the S. K. F. Ball Bearing Company of Hartford, Connecticut.

The two companies will be operated quite independently of each other. The former policy of The Hess-Bright Manufacturing Company will be continued except that its manufacturing facilities will be increased somewhat more rapidly to meet the constantly growing demand for its product. B. D. Gray, who retains his former stock holdings, will continue to manage the business as President. F. E. Bright retires from active participation in the company's affairs, but remains identified with the Company as Chairman of the Board. Aside from these two changes, the organization remains as before.

The Directors are:

F. E. Bright, Chairman.

B. D. Gray, President of The Hess-Bright Manufacturing Company.

Willard Parker Butler, of New York City.

Arthur V. Morton, Vice-President of the Pennsylvania Company for Insurance on Lives and Granting Annuities, of Philadelphia.

Paul von Gontard, Managing Director of the Deutsche Waffen-und Munitions Fabriken, Berlin, Germany.

DISTINCTIVE

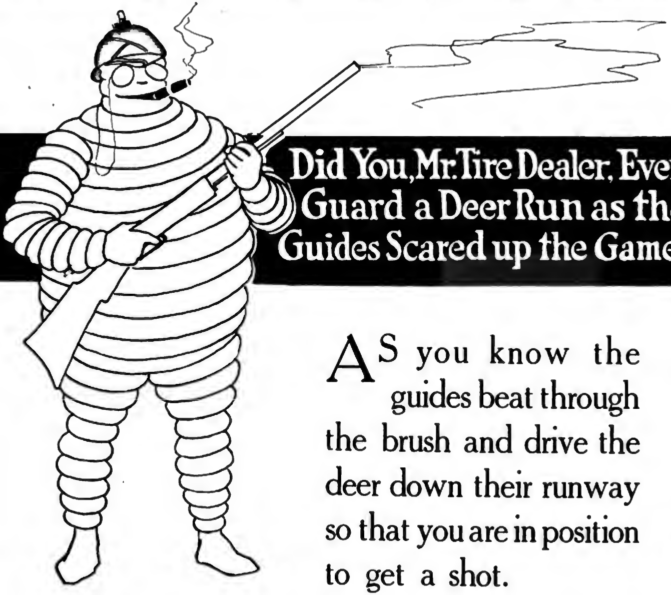
IN THE REFINEMENT OF THEIR RACEWAYS

It is this particular characteristic of Gurney construction that has most to do with establishing that Gurney quality shown in their extreme capacity and endurance.

Obviously, a ball bearing can be no better than its raceways. The balls must live and perform all their functions in the raceways. Every stress put upon the balls is borne in exactly equal degree by the raceways. The quality of each is equally vital to the quality of the bearing.

Gurney Ball Bearings, while they may not have any better balls than other first-class bearings, are nevertheless exclusively distinctive in the refinement of their raceways.

GURNEY BALL BEARING COMPANY
Conrad Patent Licensee
Jamestown, New York
Chicago New York City



Did You, Mr. Tire Dealer, Ever Guard a Deer Run as the Guides Scared up the Game?

AS you know the guides beat through the brush and drive the deer down their runway so that you are in position to get a shot.

As concerns your business we play the part of the guides and you are the hunter.

But we do more than guide.

Absolutely unsurpassed in quality—yet priced almost as low as the cheapest. The Finest Quality Tire Possible to Produce—at the price of an ordinary tire.

NOT only do we "dig up" the prospects for Michelin dealers with our dominating general advertising—but by virtue of the high quality of our product (with its surprisingly moderate retail price) in conjunction with this rapid fire, continuous general advertising campaign, we send tire buyers right into your store.

And this is only one phase of our co-operation with you dealers.

In its entirety the new Michelin co-operative dealers' proposition is the most attractive tire selling plan ever presented to the dealers of this country. It is a sure-fire big money-maker—not only in the sale of Michelin tires, tubes and accessories—but in its effect upon your entire business.

At least let us outline this plan to you. Write or wire us to submit details immediately.

MICHELIN TIRE COMPANY

MILLTOWN - - - NEW JERSEY

THE WINTON AT THE OPERA, NEW YORK

BOSCH

WINTON CARS HAVE BEEN BOSCH-EQUIPT FOR SEVEN YEARS

THE continuous use of Bosch Magneto Ignition by the makers of high grade motor cars is proof in itself of the superiority of Bosch Ignition.

Producers of high grade cars are extremely careful of their purchasers' requirements. Each item, each accessory which has to do with comfort or confidence is selected because of its superiority—not because of its price.

The Winton Company knows the Bosch name to be the symbol of satisfaction, knows that the very mention of Bosch establishes a feeling of confidence where confidence is most required, knows what's required of an ignition system and knows that Bosch meets the requirement best.

Wintons have been Bosch-Equipt for seven years—Winton owners have always been satisfied—of course.

Be Satisfied

For that feeling of confidence
For that extra ounce of power
For that vim, vigor and snap

Specify Bosch

Service Stations in Every State

Magneto Catalogue on Request

BOSCH MAGNETO COMPANY

220 WEST 46th STREET

NEW YORK CITY, N. Y.

Stop!—Are You Going to Be One of the 50 New HAL Dealers?

They Say:

Winfred Smith, Indianapolis, says:—
"The aristocrat of the road."

Mr. Hollander, New York, says:—
"Remarkable performance."

Boston Post says:—
"A most powerful car."

Web Brown, of Youngstown, said:—
"Close your eyes and you don't know you are in a car."

We Say:

A MOTOR CAR isn't worth a whoop to you unless you can make money with it.

THE PROOF OF A CAR is in its ability to sell fast enough for you to make money handling it.

Our dealers are making money handling "HAL

Los Angeles Times, Sept. 3, 1916:—
"Flexibility is a feature."

Bridgeport Evening Post, Sept. 25, 1916:—
"The 'HAL' will revolutionize motoring."

George M. Davis, Richmond, Va., says:—
"It is the most powerful motor car in the world."

Cleveland Leader, October 1, 1916:—
"It is a car that challenges attention."

Mr. McKinstry, Atlanta, Ga.:—
"'HAL TWELVE' every inch a car."

Bridgeport Telegram, Sept. 27, 1916:—
"A wonder car for a wonder price."

Mr. Jones, of Youngstown, said:—
"Rides like a cradle."

Mr. Woodruff, Northern Ohio Distributor, says:—
"The 'HAL TWELVE' is the easiest selling car I have ever handled."

TWELVES." It is part of the policy of this strong Company, owned by a syndicate of CLEVELAND manufacturers, to start only such dealers as we know can make money handling "HAL" cars. It is also a part of our policy not to take on more dealers than we can satisfactorily give service to.

Our regular advertising campaign includes a long list of national magazines with consistent copy, rather sensational, but prepared to bring inquiries that will help sell cars.

IF YOU HAVE NOT sent in an application blank for territory, do so, TODAY. If your application is approved, we will pay your expenses to Cleveland to investigate this car.

The HALozier Co.
890 East 72nd St. Cleveland. Ohio.

TERRITORY APPLICATION BLANK

The large number of requests for territory and the fact that we never appoint a dealer for the "HAL TWELVE" unless we are sure that he is going to succeed, make this application blank necessary.

Answer the following questions as accurately as possible:

Firm Name..

Address ....

City. ....

If a partnership, names of partners
If a corporation, names of officers and directors

....

....

....

How many years have you been established........

What makes of cars do you handle..................

....

What territory do you control on these cars........

....

Have you a salesroom..............................

How many salesmen do you employ.................

Are you prepared to give ordinary service..........

Do you handle accessories..........................

....
Name of Applicant

JOHNSON CARBURETOR

Made in Detroit, the Hub of the Motor Car Industry = Used Everywhere

JOHNSON COMPANY
Makers of Superfine Instruments of Carburetion
Detroit - - - - Michigan

National Speedway Tires

Made good, to make good —and it does

Though low in price this NATIONAL "*Speedway*" Tire has the strength, the stamina, the appearance, the workmanship and the *plus* value you want in a tire.

It has all the qualifications necessary to meet the demand for a *good* tire at a *reasonable price.*

It wins buyers and keeps them because it consistently delivers more than the average amount of mileage and successfully stands more than the average amount of punishment.

In a word, it is made good, to make good, *and it does.*

During the past year the NATIONAL *Speedway* tire has established a great name for itself. From the first day it was introduced it created a demand that completely over-taxed our capacity and has been the cause of increasing NATIONAL production ten fold *—all within the short space of a year.*

Tire Dealers—Tire Jobbers

You know the kind of a tire you can handle most satisfactorily and most profitably.

It is a well conceded point among successful tire dealers that territorial control of a good tire that sells at a reasonable price and that is well advertised, represents the verv best kind of a tire to sell.

On such a basis, tire dealers are not forced to compete for business against price cutting competition on the same tire or against curb stone brokers, or *against even the factory itself.*

Before contracting for your next season's supply of tires, look over the NATIONAL proposition.

Get an idea of what we can do for you

There are many good things in store for NATIONAL dealers.

Let us tell you about them.

We are making contracts for 1917 NOW.

NATIONAL RUBBER COMPANY, Pottstown, Penna.

A Change In Hyatt Service

The Hyatt Roller Bearing Company has contracted with the Bearings Service Company to conduct its service business throughout the United States.

The Bearings Service Company is establishing a direct service branch in each city of importance. Automobile dealers, garagemen and owners will receive at these branches the same cooperation and prompt, careful attention that has marked Hyatt service in the past. In addition many more cities will be served by the new Branches constantly being opened.

Bearings Service Company Branches

have already been opened in the following cities:

ATLANTA—
215 Peachtree Street
Phone Ivy 1483

BOSTON—
835 Beacon Street
Phone Back Bay 1015

CHICAGO—
2641 Michigan Ave.
Phone Calumet 989

DALLAS—

DETROIT—
997 Woodward Ave.
Phone North 6005

KANSAS CITY—
2205 Grand Avenue

LOS ANGELES—
Cor. 12th St. and
Grand Avenue
Phones: Home S-6383
Broadway 8053

MINNEAPOLIS—
1628 Harmon Place
Phones: N. W. Nicollet 3010
T. S. Center 3863

NEW YORK CITY—
238 West 56th St.
Phone Circle 587

SAN FRANCISCO—
366 Golden Gate Ave.
Phone Prospect 2276

SEATTLE—
Cor. Pine St. and
Bellevue Ave.
Phone East 627

HYATT ROLLER BEARING CO.

DETROIT CHICAGO
NEWARK, N.J.

KING 8

The Right Road

to motor car satisfaction is the one that leads to a KING

THIS pioneer "Eight" looks toward the new year from a vantage point occupied by but few cars. Its mechanical excellence has been proved over a long period of world-wide operation and in many record-breaking road trials. The grace and comfort of the three styles of body are worthy of the perfect mechanism beneath.

For 1917 the chassis will be little changed, as the King Company does not wait for "popular" announcement seasons to make such improvements and refinements as are deemed desirable by its hypercritical engineers. The body models will be kept abreast—where not a little ahead—of the latest and best in the coach building art.

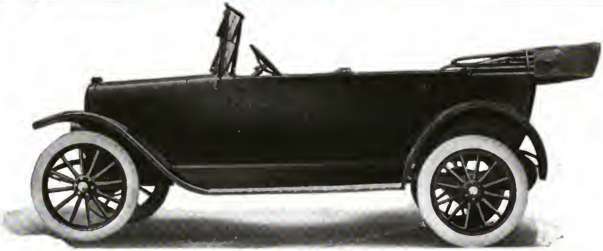
Prices on all King models will advance at an early date. A substantial saving may be effected by those who purchase now.

7-passenger, 60 Horse Power Touring Car, $1400
Roadster, $1400 *Sedan, $1950* *Prices F. O. B. Detroit*

KING MOTOR CAR COMPANY
DETROIT

The EME

EMERSON



"The Lowest-Priced 110-Inch Wheelbase Car in the World!"

$395

In a former advertisement we dwelt upon the comfort and convenience, the low upkeep cost, the graceful lines and roominess of the EMERSON "FOUR."

We now present for your consideration a detailed description of the elements which compose this car.

Read this over, consider the quality and up-to-date features of the component parts—then look at the price!

SPECIFICATIONS

MOTOR—The Emerson motor is four-cylinder, four-cycle, cast en-bloc, 3¾" bore, 4" stroke, three-bearing crank shaft. 22.4 horsepower, A. L. A. M. rating.

The cylinder head is removable, giving access to the pistons and valves, being a point in favor of greater economy of upkeep. The lower crank case is so cast that the oil bottom is made of pressed steel and is removable, which gives the same accessibility to the bearings and other parts of the motor as the removable head does to the top of the motor. Bearings standard size.

The oil is circulated by flywheel and splash.

The motor is cast with a standard S. A. E. No. 5 housing, which completely encloses the flywheel and receives the transmission.

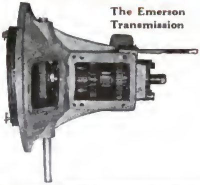
The transmission is bolted to the bell of the motor, which forms the unit power plant.

CLUTCH—The clutch is multiple disc type of the latest known successful and tried pattern, and runs in oil.

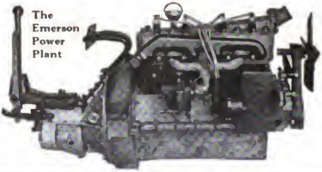
TRANSMISSION—The transmission is three speeds forward and one reverse, selective type. Shafts are of standard size. The gears standard size throughout. Bearings standard size throughout. Change gear lever directly over gears, ball and socket type of shift. Emergency brake directly alongside the cane handle shifting lever.

UNIT POWER PLANT—This type of construction, wherein the motor is connected in unit with the transmission by clutch, is the type of construction that has gained in popularity more rapidly than any other, and is today recognized as the standard, and is known as the **Unit Power Plant.** This Unit Power Plant is constructed with **three-point suspension.**

UNIVERSAL JOINTS—The double universal joint with propeller shaft between connects the unit power plant with rear axle. Both joints housed so as to retain lubricants.



The Emerson Transmission



The Emerson Power Plant

RSON FOUR

EMERSON

$395

AXLES—The front axle is drop forged I-beam, specially heat treated, with cup and cone bearings in front wheels. Knuckles and bolts heat treated.

The rear axle is semi-floating. Shafts are of ample size to carry the load. Standard differential, geared 4¼ to 1. Bearings Hyatt, standard sizes. Ball bearings in front of pinion. Short third member. Strongly and sturdily built. Brakes 10" internal and external—act smoothly and quickly.

SPRINGS—Front—long semi-elliptic. Length 32 inches. Rear—underslung, long, very resilient, conducive to easy riding. Length 42 inches.

HOTCHKISS DRIVE—Our method of spring suspension permits us to make use of the latest, most up-to-date and simplest device known, that is, the **Hotchkiss Drive.**

STEERING GEAR—Worm and sector type. Its ease of action and control over the car is remarkable.

Left-hand drive. [Right-hand drive for export only.]

RADIATOR—Honeycomb. Sufficient capacity to insure perfect cooling.

GAS TANK—On rear—capacity 10 gallons. Gasoline fed to carburetor by **vacuum system.** This location of the gas tank is only another point of comfort.

WHEELS—Front—30" x 3", clincher rims. Rear—30" x 3½", clincher rims.

These sizes are standardized by other large producers of cars.

FRAME—Pressed steel, of sufficient dimensions to form the foundation on which to install our other valuable and up-to-date features, and is of strength sufficient to withstand all conditions the car may be subjected to.

LAMPS—Electric, two heads and tail, with dimmer attachment.

ELECTRIC EQUIPMENT—Generator on front right hand side of the motor, gear driven. [**Starter left rear side of motor. Very readily attached when ordered as an extra.**]

IGNITION—Atwater Kent distributor.

BATTERY—Wet storage.

CARBURETOR—Standard float feed.

WHEELBASE—110 inches.

TREAD—Standard 56" only.

ROAD CLEARANCE—9½ inches.

BODY—In the further carrying out of our ideas we have designed a neat full stream line body, the symmetry of the lines melting into each other from the honeycomb radiator in front to the rear.

The rear seat is very roomy as to width and leg room as well as the front seat.

TOP—One-man.

FINISH—Black and nickel; no options.

TRIMMINGS—Imitation leather.

FENDERS—Last, but not least, we deck this chassis with a set of beautifully mounted and snappy crown fenders.

EQUIPMENT—Electric horn, tool kit, tire repair kit, jack and pump.

APPOINTMENTS—The car as a whole with its up-to-date and standard chassis—full stream line body—with slanting windshield and one-man top—with weight of approximately 1,800 pounds—gives to the consumer a snappy car that is pleasing to the eye, and satisfactory to the last degree in action on the road. **The EMERSON "FOUR" is the car long sought after.** With a distinctiveness all its own—with its marvelous economy in all respects (as to gas, oil, tires and upkeep)—its ease of control—its wonderful hill-climbing propensities—its easy riding qualities—these make it the popular car that it is.

PRICE—$395.00 F. O. B. factory.

$470.00 F. O. B. factory equipped with electric starter, speedometer and tire carrier.

The above are guaranteed to be the exact specifications of the Emerson "Four," but, of course, the right is reserved to make such refinements and changes as may be deemed advantageous to the product. The standard guarantee of the National Automobile Chamber of Commerce, Inc., applies to every Emerson "Four."

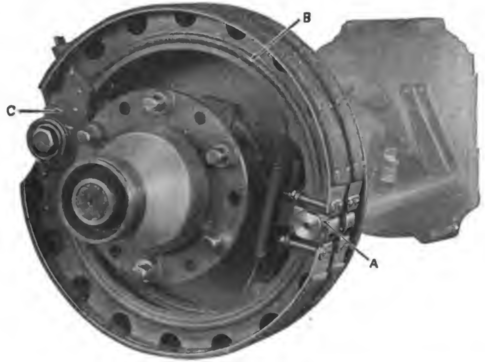
Dealer applications are arriving with every mail, and we shall be ready to close agency contracts beginning December 15th. Hadn't you better write us today?

Factory No. 2, Kingston, New York.

THE EMERSON MOTORS COMPANY, Inc.

Executive Offices
47 West 34th Street, New York City

Factory No. 1
Sixth Street, Long Island City, N. Y.



American Axles

Made by the Pioneer Axle Builders of America

Licensed under The Kardo Company Patents

Again Speaking of Brakes—

A. That part of brake shoe coming into contact with rectangular brake block is hardened and replacable.

B. The main part of brake shoes is pressed from sheet steel, materially decreasing the weight under that of cast shoes ordinarily used.

C. The centering and aligning parts of brake shoes are machined from drop forged steel.

First to introduce pressed steel into motor axles; **First** in the successive improvements that have counted most in axle manufacture; naturally, "American" Axles are **First** in the refinements that make for Less Weight and Greater Efficiency.

The American Ball-Bearing Company

Cleveland, - - - - - - - - - Ohio

Blocking Motoring Troubles with – Firestone ACCESSORIES

IN any great system of travel service, the first duty is to safeguard public welfare and insure comfort. It is so with Firestone builders. From the first step in the making of Tires to the smallest detail of Accessories, the Firestone System blocks trouble and makes good going. Firestone Accessories are strong in service, sure in results, and in every detail measure up to the Firestone standard of Most Miles per Dollar. The Firestone Cementless Tube Patch is a good example of how much quality counts in little things. They are easiest to apply and they "stay put." Note the tab on protecting muslin for quick, convenient removal. The Firestone Accessory Line includes: Hook-On Boots for Clincher or Straight Side Tires, Lace-On Boots, Blow-Out Patches, Pure Gum and Red Wrapped Tube Patches, Cure-Cut, Cement, Air Pressure Gauges, Tire Tape, Tire Mica, etc., all of that quality which has made the name "Firestone" mean confidence.

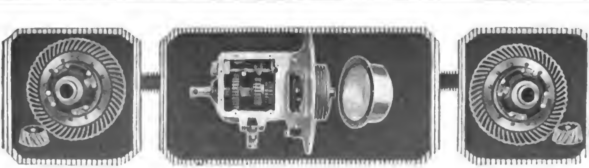
[Firestone Cementless Tube Patch Free. To prove the success of Firestone Patches, we will send you one free. Also ask for book, "Mileage Talks."]

FIRESTONE TIRE & RUBBER COMPANY
"America's Largest Exclusive Tire and Rim Makers"
Akron, Ohio—Branches and Dealers Everywhere

FIRESTONE HOOK-ON BOOT
For Clincher or Straight Side Tires
Easy to apply and sure to hold.

FIRESTONE "CURE-CUT"
A soft, strong rubber gum for filling in tread cuts and snags.

FIRESTONE INSIDE BLOW-OUT PATCH
Strong and reliable—hold tire securely after cut or blow-out.



This list of users of Brown-Lipe products—both motor car and motor truck manufacturers—is convincing evidence of the fact that,

When you buy Brown-Lipe products you buy every insurance against trouble, failure and depreciation that is afforded by long experience and the most careful attention to manufacturing detail.

BROWN-LIPE

Abbott Motor Car Co.
Acason Motor Truck Co.
Acme Wagon Co.
Ahrens Fox Eng. Co.
Amboy Motor Truck Co.
American Express Co.
Anderson Elec. Car Co.
Armleder, O. Co.
Atlantic Elec. Vehicle Co.
Atlantic Refining Co.
Atterbury Motor Car Co.
Auburn Automobile Co.
Auto Car Co.
Auto Construction & Eng. Co.
Available Truck Co.

Baker, R. & L. Co.
Barker, C. L.
Barley Mfg. Co.
Bartholomew Co.
Bessemer Motor Truck Co.
Bowling Green Motor Truck Co.
Brockway Motor Truck Co.
Buick Motor Co.

Cadillac Auto Truck Co.
Cadillac Motor Car Co.
Case, T. M. Co., J. I.
Chandler Motor Car Co.
Chase Motor Truck Co.
Chester County Motor Truck Co.
Chevrolet Motor Co.
Chicago Pneumatic Tool Co.
Cole Motor Car Co.
Coleman Carriage Co.
Columbia Taxi Cab Co.
Commerce Motor Car Co.
Corbitt Automobile Co.
Crawford Automobile Co.
Croce Auto Co.
Crossley Motors, Ltd.
Crow Motor Car Co.
Cunningham, Jas. & Son Co.

Daniels Motor Car Co.
Dart Motor Truck Co.
Davis Car Co.
De Kalb Automobile Co.

Detroiter Motor Car Co.
Detroit-Wyandotte Motor Co.
Diamond Motor Car Co.
Doane Motor Truck Co.
Dorris Motor Car Co.
Dort Motor Car Co.
Duplex Power Car Co.

Eclipse Motor Truck Co.
Empire Automobile Co.
Enger Motor Car Co.

Federal Motor Truck Co.
Fiat Co.
Fifth Ave. Coach Co.
Four Wheel Drive Auto Co.

Gabriel C. & W. Co.
Garford Motor Truck Co.
General Motors Truck Co.
General Vehicle Co.
Gramm-Bernstein Co.
Gramm Motor Truck Co.
Grant Motor Co.

Hahn Motor Truck Co.
Harding Motor Truck Co.
Harvey Motor Truck Works
Harwood Barley Mfg. Co.
Haynes Automobile Co.
Henderson Bros.
Hendrickson Motor Truck Co.
Hudson Motor Car Co.
Holmes Motor Truck Co.
Hurlburt Motor Truck Co.
Hupp Motor Car Co.

International Harvester Co.
International Motor Co.

Jackson Auto Co.
Jordan Motor Car Co.

Kelly-Springfield Motor Truck Co.
King Motor Car Co.
Kissel Motor Car Co.
Kleiber & Co.
Knox Motors Associates
Krebs Commercial Car Co.

Landshaft Motor Truck Co.
Lewis-Hall Iron Works
Lexington-Howard Co.
Lippard-Stewart Motor Car Co.
Lozier, H. A., Co.
Luverne Auto Co.

McFarland Motor Co.
Maccar Truck Company
Martin Carriage Works
Menominee Motor Truck Co
Mercer Automobile Co.
Meteor Motor Car Co.
Milburn Wagon Co.
Mitchell Motor Car Co.
Moline Automobile Co.
Monroe Motor Co.
Moon Motor Car Co.
Moreland Motor Truck Co.
Motor Trucks, Ltd.
Mutual Motors Co.

National Motor Vehicle Co.
National Steel Car Co.
Nelson & Le Moon
New England M. T. Co.
Niles Car & Mfg. Co.
Nordyke & Marmon Co.

Oakland Motor Car Co.
Ohio Electric Car Co.
Old Reliable M. T. Co.
Olds Motor Car Co.
Owen Schoeneck Co.

Paige-Detroit Motor Car Co.
Palladium Auto Cars, Ltd.
Palmer-Moore Co.
Palmer-Myer Co.
Pathfinder Co.
Paterson Co., W. A.
Peerless Motor Car Co.
Pullman Motor Car Co.

Republic Motor Truck Co.
Riddle Coach & Hearse Co.
Ross Automobile Co.
Rowe Motor Mfg. Co.
Rush Delivery Car Co.

S. G. V.
Sandow Motor Truck Co.
Sanford Motor Truck Co.
Schacht Motor Truck Co., G. A.
Schafer-Decker Co.
Scripps-Booth Co.
Selden Motor Vehicle Co.
Service Motor Truck Co.
Shaw, Walden W. Livery Co.
Signal Motor Truck Co.
Singer Motor Co.
South Bend M. C. Works
Standard Oil Co.
Standard Steel Car Co.
Standard Motor Truck Co.
Stegeman Motor Car Co.
Sterling Motor Truck Co.
Stewart Motor Corp.
Stutz Motor Car Co.
Sullivan Motor Car Co.

Tait Bros.
Taxicab Service Co.
Thomas Auto Truck Co.
Tiffin Wagon Co.
Trabold Truck Mfg. Co.
Trafford Eng. Co.
Transport Tractor Co.
Tower Iron Works, R. J.

United Motors Co.
U. S. Carriage Co.
U. S. Motor Truck Co.

Velie Motor Vehicle Co.
Vim Motor Truck Co.

Walker Vehicle Co.
Ward M. V. Co.
Watson Wagon Co.
Way-Cleanes Co.
Westcott Motor Car Co.
Wichita Falls Motor Co.
Wilcox Motor Co., H. E.
Willingham S. Sons, E. G.
Winton Motor Car Co.
Witt-Will Co.

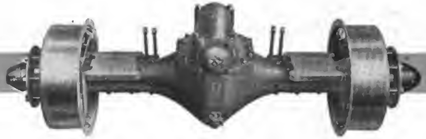
Yellow Cab Co.

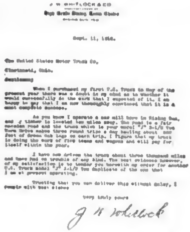
Zeitler & Lamson

BROWN-LIPE GEAR CO.
SYRACUSE TRANSMISSIONS N. Y.

BROWN-LIPE CHAPIN CO.
SYRACUSE DIFFERENTIALS N. Y.

NEW YORK, Thos. J. Wetzel, 29 West 42d St.
SAN FRANCISCO, A. H. Coates, 444 Market St.
CHICAGO, K. Franklin Peterson, 122 S. Michigan Ave.
DETROIT, L. D. Bolton, 2215 Dime Savings Bank Bldg.
Foreign Agent, Benjamin Whittaker, 2, Norfolk Street, Strand, LONDON, W. C.





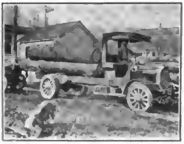
These illustrations give rather strong evidence of the extreme efficiency of the worm drive under unusual conditions.

Mr. Whitlock's letter, in which he orders his second truck, tells better than any solicitation we might make of the capacity and all-around efficiency of his worm driven U. S. Motor Truck.

It is the continued similar performance of worm driven trucks, day in and day out, throughout the world, that has made the worm drive the dominant type for truck final drive, from the smallest to the largest capacity.

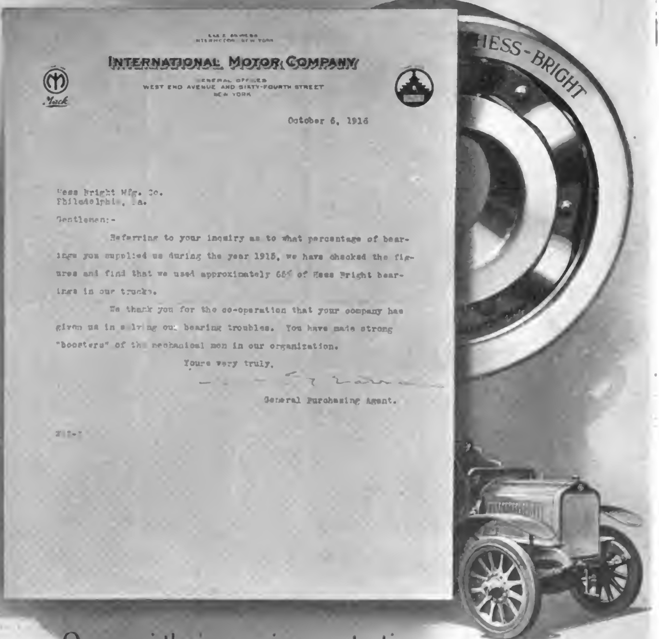
SHELDON AXLE & SPRING CO.
WILKES-BARRE PENNA.

SHELDON



HESS-BRIGHT BALL BEARINGS

"THE INIMITABLE BEARING"


HESS-BRIGHT

INTERNATIONAL MOTOR COMPANY
GENERAL OFFICES
WEST END AVENUE AND SIXTY-FOURTH STREET
NEW YORK

October 6, 1916

Hess Bright Mfg. Co.
Philadelphia, Pa.

Gentlemen:-

Referring to your inquiry as to what percentage of bearings you supplied us during the year 1915, we have checked the figures and find that we used approximately 68% of Hess Bright bearings in our trucks.

We thank you for the co-operation that your company has given us in solving our bearing troubles. You have made strong "boosters" of the mechanical men in our organization.

Yours very truly,

General Purchasing Agent.

Our rapidly increasing production
will enable us to more fully meet
the requirements of our customers

THE HESS-BRIGHT MANUFACTURING COMPANY

PHILADELPHIA, PA.

HESS-BRIGHT'S CONRAD PATENTS ARE THOROUGHLY ADJUDICATED

A New and Better Fire Fighter

Shoots a Greater Volume of Liquid to a Longer Distance

More efficiency! There is no loss of liquid, no dribble, between nozzle and the point of fire contact—every drop of liquid is used when and where needed. Pump capacity is great enough to permit operator standing 25 feet away, so as to

Fight the Fire—at a Safe Distance

Pressure is compounded so continuous pumping is unnecessary. Stream may be shut off at will—by a simple turn of handle—or thumb may be placed over nozzle when changing the aim.

A dent in the shell does not interfere with the action of the machine —*it's always ready to shoot!*

LOW FREEZING POINT A FEATURE

Fyr-Fyter will not freeze at 50° below zero—a temperature rarely reached.

Fyr-Fyter NEVER FAILS

A Child Can Operate Fyr-Fyter

Its harmless liquid compound forms a heavy, flexible gas blanket which smothers fire by cutting off the oxygen. It is free from acids, alkalis, moisture or other injurious ingredients—a nonconductor of electric currents, and will extinguish electrical short circuits as well as all forms of incipient fires, including gasoline.

Save 15% on Your Fire Insurance Bill

The Fyr-Fyter has been approved by the Underwriters Laboratories. Installed on your car, Fyr-Fyter will save you 15% on the fire insurance bill.

A prominent fire chief once said that all fires were the same size at the start. The best protection and prevention is to have a Fyr-Fyter instantly available—in the home, garage, motor car, boat, store, factory, shop. Don't wait for the fire department. Be ready for action—instantly with Fyr-Fyter.

Dealers Write for Special Offer

Ample capital enables this Company to give wide publicity to this *new and better Fire Extinguisher.*

Our extensive advertising campaign will help you—get the new business.

Write today for special offer and full particulars.

Fyr-Fyter Company
DAYTON, OHIO

FYR-FYTER CO., Dayton, Ohio
Send me full particulars of your special proposition to dealers selling Fyr-Fyter, the new weapon for fighting fire.
Name..........
Address..........
City..........
State..........

Thermoid

GASOLINE HOSE

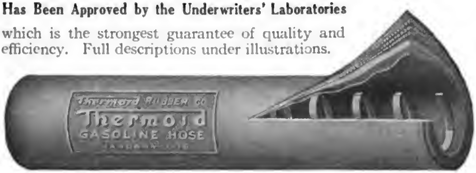
Safest for Public and Private Tanks

Ordinary hose will not do for a gasoline tank. Many garages and private owners are using inferior hose for this purpose and thus exposing the lives and property of their patrons and themselves.

Here are two grades of Gasoline Hose—**Thermoid** and **Testoid.** Both guaranteed. Thermoid, our best grade,

Has Been Approved by the Underwriters' Laboratories

which is the strongest guarantee of quality and efficiency. Full descriptions under illustrations.



Thermoid Gasoline Hose is made with inside tube reinforced with one-ply, high-grade duck, reinforced and held in place by a flat, coiled, steel wire. The ½", ⅝" and ¾" sizes are made with three plies of duck between tube and cover. The 1", 1¼" and 1½" sizes have four plies.

Testoid Gasoline Hose is made of the same materials—tube, fabric, friction and cover—as Thermoid, but it does not have the one ply of duck inside the tube. Testoid is not reinforced with steel wire inside. We guarantee Testoid same as we do Thermoid.

"Steel Grip" Wire Wound. Both brands of our Gasoline Hose can be had wire wound. This steel wire is very hard and can't unwind. "Steel Grip" wire wound hose is very flexible and won't kink.

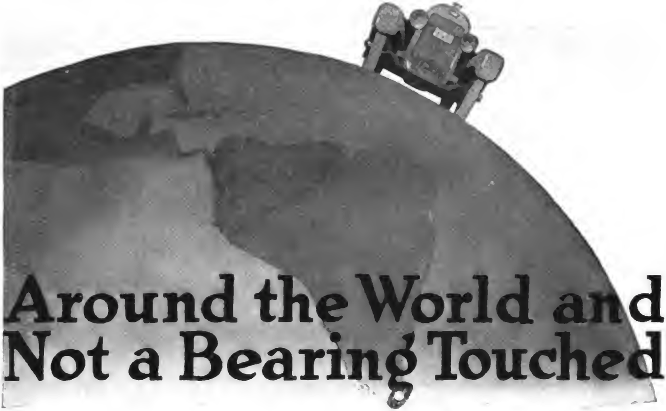
Both Thermoid and Testoid can be had wire wound outside. The garage and private tank owner should know the danger of using ordinary hose. Remember our

Guarantee—Thermoid and Testoid Gasoline Hose Will Make Good or We Will

Thermoid Rubber Company

Makers of Thermoid Brake Lining and Nassau Tires

Factories and Main Offices: Trenton, N. J.



Around the World and Not a Bearing Touched

25,000 miles! The circumference of the globe—over eight times the distance from New York to San Francisco—that's what a Ferro "V" motor has traveled without attention being given a single bearing. And it's still running, smoothly and quietly, apparently good for many more miles without overhauling.

The motor is the sixty horsepower model, with which the forty-eight horsepower model is identical in every respect, save size.

The record is all the more notable, because it was made with a service or "knockabout" car, which has been subjected to considerable abuse. The car is a standard stock model, used at the Ferro plant.

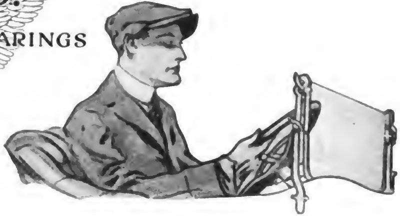
Aside from the removal of carbon and regrinding of valves, not a bit of tuning up has been done on the motor.

Write today for full information

THE FERRO MACHINE & FOUNDRY COMPANY
1193 Hubbard Ave. Cleveland, Ohio

FERRO MOTORS
Reg. U.S. Pat. Off.

U.S.
BALL BEARINGS



When You Start Your Car

One very important characteristic, which is exclusive of annular bearings, is the fact that the co-efficient of friction at rest (so-called) is practically no greater than it is in motion. In other words, there is practically no greater frictional loss with an annular ball bearing used at the moment of starting your car or truck than there is when the car is running at speed.

On the contrary, with any other type of bearing, the amount of friction that must be overcome at the moment of starting is many, many times greater than the friction of that bearing after the load has been put into motion.

Starting with the fact that the ball bearing originally uses only from one-third to one-fourth the power by friction that any other type of bearing uses,

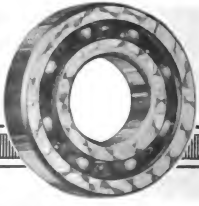
And then taking into further consideration the fact that at the starting moment any other type of bearing uses maybe a dozen to twenty times as much power by frictional loss as a ball bearing,

It is easy to see that this characteristic is important in considering the efficiency of various types of bearings.

This is a particularly important point for owners of cars and trucks, that start frequently and stop frequently, to consider.

U. S. Ball Bearing Manufacturing Co.
(Conrad Patent Licensee)
Palmer Street and Kolmar Avenue, Chicago

U. S. Ball Bearings are made in a modern factory of 10,000 Quality Bearings a day capacity.



INDIANAPOLIS
STUTZ
INDIANA. U.S.A.
World's Champion

WORLD'S
Speedway Champion

WORLD'S
Road Race Champion

World's Long Distance
Records 300; 350 - miles

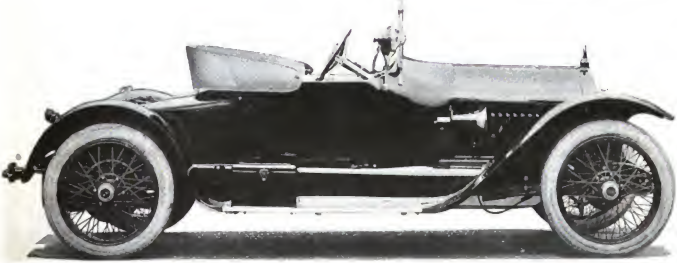
World's Record for Consistency
4 Consecutive 1st & 2nds

These Records Still Stand

Stutz Racing Records are unequalled after two years of competition by the better motor mechanisms of America and Europe, for the same reason that the Sturdy Stutz is giving unequalled service in owner's hands.

STUTZ MOTOR CAR CO.
Indianapolis, Indiana, U. S. A.

Stutz Roadster	-	*$2,275*
Other Models	-	*$2,550*



STUTZ

Departments of Your Plant

E. W. P. Alloy Valves

This valve is an example of the superior results secured by specializing on production of one part.

E. W. P. Alloy is a steel "built up" in this company's laboratories by using several constituents, each one of which contributes some quality essential to valve service.

Valves made from this alloy have been used for several years by representative motor manufacturers.

We furnish valves of any materials, but believe E. W. P. Alloy will give you exceptional service at a reasonable cost.

The Steel Products Co. (Main Plant)
CLARKWOOD RD. CLEVELAND, O.

Drag Links

This important part will receive in our plant the same careful attention that you would give it yourself.

In addition to this you get the benefit of experience gained by engineers and workmen who have built drag links for a large percentage of all the motor cars on the market.

Michigan Electric Welding Plant
Hart Ave. Detroit, Mich.

Portable Welders

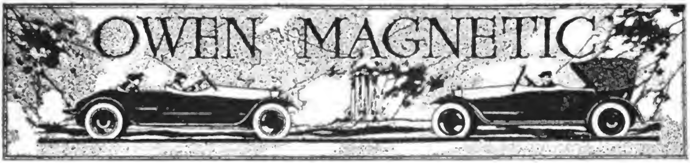
These outfits contain welding torch, nozzles, regulators, instruction book and every item except the tank, necessary for acetylene welding in any metal.

The quality of each piece is the highest yet, the outfits are reasonable in price and suited for service station and garage as well as your more exacting shop work

Metals Welding Plant
4400 Perkins Ave. Cleveland, O.

Please address inquiries to individual plants

The Steel Products Co.



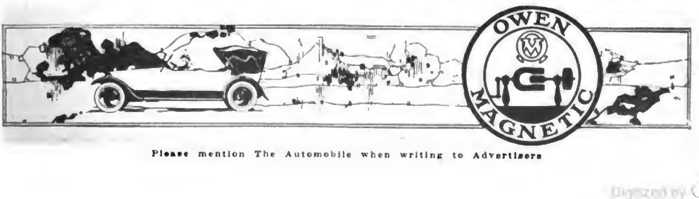
"—And if you are an accomplished driver, you will thank high Heaven for the wonderful, luxurious joy that fluid control of motion puts into Life, when you feel under your hands, the sheer, elastic melody of force and all the exquisite refinements, its infinitesimal gradations which the Owen Magnetic gives and which nothing else on wheels DOES give. You will play on this refinement of power and speed elasticity, this fluid thunderbolt responsive to your slightest touch, play on this soundless volume of concentrated etheric force, as a great master rolls out the volumes of an organ's melody, and hushes them to a whisper of blending, melting tones, as the genius of the spirit bids him."

You want to know just HOW you can drive this way; don't you? This magazine tells you in the November 30 issue, in a four-page story, illustrated in ten colors. But since you are in the mood to read it NOW, won't you let us send you a personal copy in advance? Drop us a card —we will value your request.

BAKER R. & L. COMPANY, Inc.
CLEVELAND, OHIO

Manufacturers
OWEN MAGNETIC MOTOR CARS

Salesrooms
NEW YORK BOSTON PHILADELPHIA CHICAGO



Pneumatic and Solid

TIRES

As a subject of direct interest to the industry, the trade and to car owners none is more general than tires. Its importance cannot be minimized, and we are sure that much good will result from the exhaustive treatment to be given it in next week's issues of

The Automobile *Motor Age*
Motor World

The plan of special issues which exhaustively cover particular phases of interest has been accorded genuine appreciation by the engineering and manufacturing departments of the industry, by dealers and garage owners who sell and maintain the industry's products, and by car owners.

And because each of our three papers functions for a separate reader clientele, the necessity for a distinct difference of editorial treatment for the same subject in each paper is obvious. That is the reason for three papers. They develop three classes of interest, and can, therefore, be depended upon to render a more complete and satisfactory service to their respective classes than if attempt were made to publish a paper that would "blanket" all classes.

In the forthcoming special issues covering Pneumatic and Solid Tires, The Automobile will feature the engineering and manufacturing phases for the advantage of the industry. Motor World will consider the subject from the interest point of car dealer, garage owner and repairman—maintenance, repair, adjustments, etc. Motor Age will present a wealth of information pertaining to the care necessary to give tires by the car owner.

In our issues for the following week (Nov. 30) Electric Lighting and Starting will have the center of the stage, and in the issues of the succeeding week (Dec. 7) Ignition will be featured. In the Dec. 14 issues the subject of Carburetion will be covered thoroughly.

All of these special issues will be unusual in the matter of interest for the reader and, therefore, of particular value to advertisers.

The Class Journal Company

Publishers of

The Automobile *Motor World* *Motor Age*

NEW YORK
239 W. 39th St.

CHICAGO
Mallers Bldg.

GUARANTY PLAN
AUTOMOBILE Time Payments

To Finance Your Winter Storage Under the Guaranty Plan You Must Act Now

GUARANTY PLAN
COMMERCIAL CAR Time Payments

Dealers and Distributors in cars recognized under the Guaranty Plan have in the last few weeks requested over $38,000,000. of Winter Storage financial assistance.

If you have not yet taken advantage of the Guaranty Acceptance Plan write or wire how much you need and on what cars you wish to borrow. Do this today. An average of 2 ¾ cents per car, per day above ordinary banking and insurance charges will store a $1000. car for four months under the Guaranty Acceptance Plan. Act now.

GUARANTY SECURITIES CORPORATION

Incorporated under N. Y. State Banking Laws

Equitable Building **New York City**

SAN FRANCISCO
Hobart Building

MONTREAL
National Trust Building

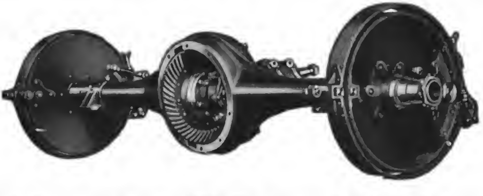
Makes of cars represented	1	2	3
If you are distributor ✓ here			
If you are direct factory dealer ✓ here			
If you are sub-dealer ✓ here			
Name of Distributor			
Address of Distributor			
No. of cars 1917 Contract			
Desire financial assistance winter storage on cars amounting wholesale value	$	$	$
I {am using / will use} GUARANTY RETAIL PLAN on cars checked			

Signature.. *Address*....................................

A. Nov. 16

Precision

THAT Columbia Axles should in every instance render service that is unusual in its freedom from trouble of any description—that they should time after time set up new records of great mileage with no repair expense whatever—is not at all remarkable when you know the precision—**the painstaking care** with which they are built.



For instance, the Differential Gears used in Columbia Rear Axles have been evolved as a result of scientific tests to determine the exact construction to produce the highest efficiency. The superiority of Spiral Bevel Gears over the plain bevels has been conclusively proved and they are therefore used in Columbia Axles.

That Columbia Axles should be unusually accessible follows naturally. The driving parts may be removed without special tools and without the removal of the wheels. The man who has had experience with other types in which it is necessary to remove the wheels before the drive shaft could be displaced will readily appreciate the great advantages in Columbia Axle construction.

THE COLUMBIA AXLE COMPANY, CLEVELAND, OHIO

COLUMBIA

AXLES

The Foundation of United Service

An Efficient Organization
and Modern Equipment

Open Hearth Building
Plant "B"

THIS building, now nearing completion, will eventually house ten 75 ton basic open hearth furnaces.

We will use in these furnaces metal from our own blast furnace and gas from our own producers.

The furnaces are of an improved type, built especially for the manufacture of alloy steels.

This new capacity will place us in an unrivalled position as manufacturers of alloy steels.

"United" Alloys have long held an enviable reputation for super-quality; this super-quality will still be maintained, alike in the new equipment and the old.

Chrome Vanadium *Chrome Nickel* *Chrome* *Silico Manganese*
Special Analysis *Nickel* *Magnet* *Chrome Silico Manganese*

THE UNITED ALLOY STEEL CORPORATION

Successors to
The United Steel Company

Basic Open Hearth *Heroult Electric*

CANTON, OHIO

The Other Half of the Goodyear Idea

GOODYEAR means to make the best automobile tires and accessories possible to make.

But this is only *half* of the Goodyear idea. The other half of the plan is to see that every purchaser of Goodyear Tires has the benefit of expert advice and assistance—so he will get the *last possible mile* out of every tire he buys.

So Goodyear has organized a *national system of tire saving*—extending from Coast to Coast and North to South.

This is the system of Goodyear Service Stations—first-class tire and accessory dealers, thousands of them, all conducted with the thought that every mile added to the service of Goodyear Tires adds to the customer's respect for Goodyear and so brings future business to the Service Station and to Goodyear.

To this end the Goodyear Service Station men inspect and inflate tires free of charge, advise the customer on how to get most wear and sell him Goodyear Tubes and Accessories, so that his whole tire equipment may match up to the quality of his casings.

Nearly all Goodyear users accept the splendid service given at these stations, appreciating the spirit in which it is rendered and realizing its dollars-and-cents value to them.

A Neat Package of Good Will

There is a lot of valuable good will done up in the Goodyear Tire-Saver Kit.

A complete assortment of first-aid-to-tire accessories for the customer—and good will for the Goodyear Service Station from which it was purchased.

Car owners everywhere are buying this indispensable Kit by the tens of thousands because it fills a great need. There is nothing else like it.

The Cheapest Tire Mileage

Applied at the proper time—before tires are too far gone—the Goodyear Inside Tire Protector frequently will add mileage far out of proportion to its cost.

It supplies reinforcement for the carcass when it needs reinforcement most—gives tires a new lease on life.

So this device is sold by Goodyear Service Stations everywhere as a part of the plan to make every Goodyear Tire deliver the *ultimate mile* of use.

The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR
AKRON

WARNER
GEAR COMPANY OF MUNCIE

In Steering Gears Quality is Imperative

Too much depends on the perfect operation of a steering gear to allow the use of inferior product.

The service required of it is too constant and too severe.

Quality of the highest order should always be the governing factor in its selection—price never.

Warner Steering Gears are built to exactly this stand.

Build WARNER DEPENDABILITY into your car

WARNER GEAR COMPANY, Muncie, Indiana
Detroit Office: 967 Woodward Avenue

L. J. MUTTY CO
BOSTON
REGISTERED TRADE MARK

There is one thing we want you to know about

BULL DOG QUALITY

in rubberized fabrics and that is, the double inspection of every piece, every yard, yes—every foot—inspected carefully at our factories and again just before it is shipped to you.

One of the largest automobile makers states:

"In Bull Dog fabrics I get a satisfactory price and a quality, every yard of which proves better than I receive from any other source."

Send for samples of Bull Dog quality for comparison with samples of other makes.

L. J. MUTTY CO.
BOSTON, MASS.

Keystone Automobile Bodies
For 1916

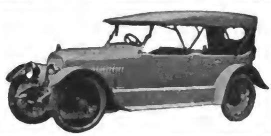
Individuality is as noticeable in motor cars as in homes. Our exclusive creations of motor car bodies are as perfect in design, finish and appointment as your own personality dictates.

We are among the oldest high grade carriage builders and are specialists on broughams, limousines, clover leaf and club roadsters.

There can be only one like yours.

Details on Request

Keystone Vehicle Company
Reading Pa.



Automobile Welding with the Oxy-Acetylene Flame
By M. Keith Dunham

This is the only complete book on the "why" and "how" of welding with the oxy-acetylene flame the various parts of the automobile.

Explains the apparatus to be used, its care and how to construct necessary shop equipment. The actual welding of all automobile parts is treated in a manner understandable by everyone.

Automobile owners, garage and service stations, blacksmith and machine shops, as well as industries using the oxy-acetylene flame will find this book of the utmost value, since the perplexing problems arising when metal is heated to a melting point are fully explained and the proper methods to overcome them shown.

192 Pages. Fully Illustrated. 1916 Edition
Price $1.00

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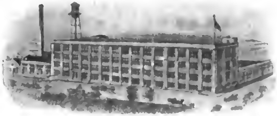
239 West 39th St., New York



Use the facilities of this perfectly equipped plant for the production of small sheet metal stampings of any design, also

BRASS CASTINGS

in the Rough, Polished or Nickel Plate

including Hub Caps, Radiator Filler Necks with Caps, Gasoline Tank Flanges with Caps, Gasoline Tank Flanges for Outlets, Hood Yokes, Ford Special Hub Caps and other parts made of Cast Brass.

Our Well-Equipped Wood-Working Department

is prepared for the prompt production of quantity orders of rough or highly finished wood-work assemblies of medium size for motor car construction, such parts as rest blocks for shipping, flooring boards, back spring boards, running boards, etc.

We work from Blue Prints and Specifications, but prefer, when possible, to also have samples for the purpose of securing positive accuracy in weight, measurements and design.

Write us at once for further information regarding the production of your requirements.

The Pfau Mfg. Co. PFAU SERVICE **Cincinnati Ohio**

230 Mentor St.

One part of your automobile you do not know you own, because it never bothered you.

ECLIPSE-BENDIX DRIVE

Transmits the power from the starter to the motor on

125 MAKES OF AUTOMOBILES

MADE BY THE

ECLIPSE MACHINE CO.

ELMIRA, N. Y., U. S. A.

If your Ford car could pick itself up and fly over country roads, the sensation would not be any more pleasant than the easy swing made possible under all conditions by—

W & C

Original Double Arm Shock Absorbers

For Ford Cars

Give Ford cars that final touch of easy riding that you expect to find only in heavy cars of much higher-priced class. Transform the jerks and bounds into even swells that you can't even imagine until you ride in a Ford, W & C equipped.

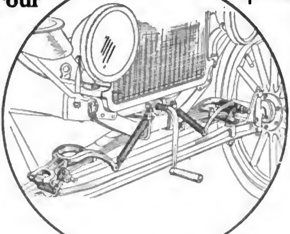
Ask your dealer today. But don't say "shock absorber." Say "W & C."

DEALERS: W & C Shock Absorbers are stocked by practically every leading dealer and jobber. If you are not already supplied, write for full details.

PHILIP H. WEBBER & COMPANY

HOOPESTON ILLINOIS

Set of Four $10



Judge Its Quality by the Company It Keeps

FOSTER OWL LIGHT

There is no more certain evidence of a car owner's discrimination and good taste than the presence of a FOSTER Owl Light on his windshield.

The highest-priced, finest built cars in the world carry the OWL Light. It is a badge of distinction. It is simple, neat, ornamental, and unobtrusive. There is nothing complicated, awkward, bulky or ugly about it. It is the handsomest spotlight possible for spotlight specialists to build.

Now only $5, complete with all connections. Sold on 10 days' trial. Ask your dealer, or if he cannot supply you, write us direct. In ordering, state make, model and battery voltage of car. Send for interesting booklet.

Thoroughly high-grade dealers wanted. Write.

C. H. FOSTER ACCESSORIES CO.

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Easier Starting in *Cold* Weather

is but one of the advantages of equipping your FORD with a

TRADE K-W MARK

MASTER VIBRATOR

Other advantages are:

Perfect Ignition—More Power.
One adjustment instead of four.
A hotter spark—Smoother running engine.
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Sold by dealers who know the difference everywhere. If you don't know yours, sent prepaid upon receipt of price.

Write for illustrated booklet

$15 With Kick Switch
$16 With Auto-lock Switch

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2833 Chester Ave. CLEVELAND, OHIO, U.S.A.

Stop at the ***Woodstock***

FORTY-THIRD ST., NEAR BROADWAY

TIMES SQUARE
THE CENTER OF NEW YORK

Located just off Times Square

The Hotel Woodstock

is within a handy walk of everything—terminals—subways—elevateds—surface lines—theatres and the automobile district, yet you can have quiet, refinement and service withal.

Single Room, with Bath . . $2.00 and $3.00 for one
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European plan restaurant unexcelled for its cuisine

Service and accomodations unsurpassed for completeness and efficiency

Write for our Map of New York

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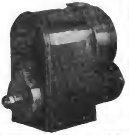
Ample Power for the Heavy Load!

When the strain is on your motor, you need 100% ignition—sure fire of any mixture, however rich or however lean! The

EISEMANN
MAGNETO

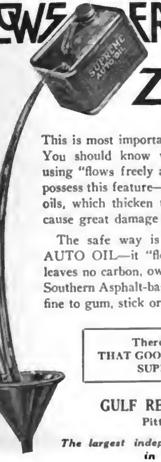
is known throughout the land for a Hot, Sure Spark at all speeds (even the lowest); Easy Starting; Simple, Sturdy Construction.

Proof: 108 Manufacturers of Trucks, Tractors, Pleasure Cars, etc., use nothing but Eisemann. Pretty good evidence?



THE EISEMANN MAGNETO CO.
Sales and General Offices:
32-33d Street, Brooklyn, N. Y.
802 Woodward Ave., Detroit, Mich.

FLOWS FREELY AT ZERO



This is most important during winter months. You should know whether the oil you are using "flows freely at Zero." All oils do not possess this feature—notably the paraffine base oils, which thicken up under cold, and often cause great damage to the motor.

The safe way is to ask for SUPREME AUTO OIL—it "flows freely at Zero," and leaves no carbon, owing to the fact that it is a Southern Asphalt-base oil, containing no paraffine to gum, stick or thicken.

There is More Power in
THAT GOOD GULF GASOLINE and
SUPREME AUTO OIL

GULF REFINING COMPANY
Pittsburgh, Pa.

The largest independent refining company in the world.

See Your Car As Others See It

Keep it looking right as a matter of personal pride, whether you own the car, or just drive it. It costs but little in time and money to have your two, three or four year old model look as well as the other fellow's this year's car.

Every car used one month needs at least one of these products

And when you sell your car—
Just about ¼ more for looks.
Appearance is a "good asset."

PEERLESS

Automobile Specialties

will keep every part of your new car looking new, and make every part of your old car look as good as new.

PEERLESS SPECIALTIES are used and endorsed by more than 8,000 Automobile Painters.

Top makers use and endorse these goods. The results they produce are both immediate and lasting. They are quality products. Insist on PEERLESS—

The name of each product tells its use

Peerless Mohair Top Dressing
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Peerless Cylinder Enamel—Black
Peerless Cylinder Enamel—Gray
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Peerless Anti-Rust Rim Paint
Peerless Auto Body Polish
Peerless Acid-Proof Battery Box Black
Peerless Extra Fine Black Japan
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One uniform price for all products.

Pint can..........	$.54	½-gallon can....	$1.98
Quart can.......	1.04	One-gallon can..	3.75

Ask for these goods at

Any Auto Accessory jobber, dealer, garage or hardware store

Where they do not have the goods in stock, send for our descriptive book, which tells all about each product.

Buy the Goods You Need—Do It Now!

The Columbus Varnish Co.
Columbus, Ohio

This Is the Plug

Have You This Plug On Your Car?

These Are the Manufacturers Who Equip With

AC

The Standard Spark Plug of America

Packard
Pierce-Arrow
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Dort
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Brockway Truck
Chase Truck
Daniels
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Graham Trucks
Kissel Kar
Palmer-Moore
Murray
Nour-Davis
Premier
Republic Truck
Kane
McLaughlin (Canada)
Monroe
Netco Trucks
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United Truck
Wilcox Trux
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Liberty
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Accept No Plug Unless AC is Burnt Into the Porcelain

Sold Everywhere

No Greater Recommendation Can Be Given a Spark Plug

Champion Ignition Co. Flint, Mich.

COUNTERBALANCED

PARK

CRANK SHAFTS

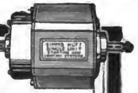
PATENT APPLIED FOR

The

PARK

DROP FORGE CO.

CLEVELAND, OHIO



SIMMS MAGNETO SIMMS-HUFF

ELECTRIC STARTING & LIGHTING

"We have had splendid results with the Simms high tension magneto and Simms-Huff motor-generator."
THE EVERETT HDWE. CO.,
Rockingham, N. C.

Quality ***Reliability***
Efficiency

The SIMMS MAGNETO CO.
273 No. Arlington Ave.
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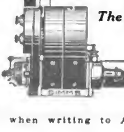
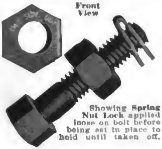




Why Not Be Sure

that every part of the engine, chassis, or body of the car you make will **stay together** until taken apart?

Showing Spring Nut Lock applied loose on bolt before being set in place to hold until taken off.

Spring Nut Locks

are the simplest, surest, safest device to positively lock any nut on any bolt. Resists all vibrations. Cannot harm threads. Easily applied. Released whenever desired.

Cheapest and Best

Manufacturers, Jobbers, Garage Men, Repair Men and **all Dealers** should **write** for prices on sizes now available. Orders filled in rotation. All sizes by January 1st.

Spring Nut Lock tightened against Nut. Prevents Nut being shaken off and follows Nut tightening against material.

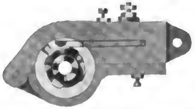
Spring Nut Lock Co.
648 Transportation Building
Chicago

Victor Carlstrom used SPLITDORF SPARK PLUGS—the Plug with the Green Jacket—in his record breaking flight from Chicago to New York.

SPLITDORF ELECTRICAL COMPANY
NEWARK, N. J.

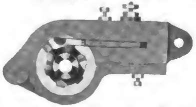
Pittsfield Distributor

Achieves an open circuit with positive mechanical make and break—entirely independent of rapidity of spring action.



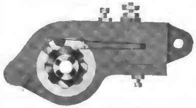
1.

This illustration shows the circuit open. As you can see, this position is maintained a greater part of the time, which means less drain on the source of current—**ECONOMY!**



2.

Now the cam has revolved and is making the contact. You will note that the contact is **FORCED.** Spring action has nothing to do with it. Also it is apparent that the contact comes at the **proper** power-moment and can come at no other time—**ACCURACY!**

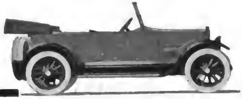


3.

The further revolution of the cam has **FORCED** the platinum points apart. "Sticking," which is the cause of electrical "lag," is impossible. Every make and every break **must** take place at the proper instant—**POWER!**

The Pittsfield Distributor is one compact unit, including the coil. Only one external wire in its construction—that leads to the battery.

Pittsfield Spark Coil Company
Pittsfield Mass.



The Hundred Point Six

The New Standard in Car Value at $1095

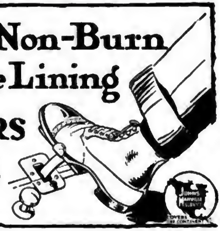
Send for Information

KISSEL MOTOR CAR CO.
HARTFORD, - WIS.

KISSELKAR
EVERY INCH A CAR

J-M Non-Burn Brake Lining

IT WEARS IT'S SAFE



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22-73 SERIES

They follow closely the lines of the preceding series, and the only changes are in the nature of refinements.

22-73 Touring
22-73 Sporting
22-73 Runabout
22-73 Raceabout
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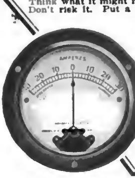
239 West 39th Street New York City

If Your Lights Should Fail!

Think what it might mean on a black night, with a bad road! Don't risk it. Put a



Weston
MODEL 354 AMMETER

On Your Dashboard or Cow!

It is a reliable means of determining the proper rate of charge or discharge of your battery for various speeds. It enables you to determine that the generator is working and that the storage battery is receiving its proper charge. *Write us.*

Weston Electrical Instrument Co.
8 Weston Ave., Newark, N. J.
Branches in the Larger Cities

Add to Garage Profits by Oxy-Acetylene Welding

Savings made please your patrons and pay good substantial profits

PREST-O-LITE
Dissolved Acetylene
(Ready-made carbide gas)

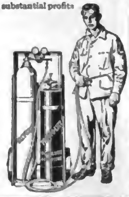
adds to the efficiency and usefulness of any good welding equipment. We furnish thoroughly high-grade welding apparatus for $60.00 (Canada, $75.00). The average user will also need gas cylinders at an additional cost, and about $10.00 worth of welding supplies. Truck and special equipment for cutting operations at extra cost.

Send for details of Prest-O-Lite Service for Oxy-Acetylene Welding.

THE PREST-O-LITE CO., Inc.
The World's Largest Makers of Dissolved Acetylene

234 Speedway
Indianapolis, Ind.

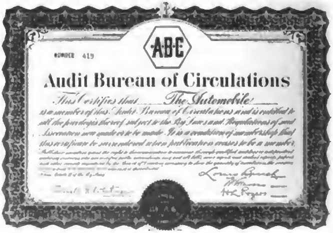
Canadian Office and Factory
Merritton, Ontario



Celfor
Internal Gear Drive Axle

There are varying arguments in favor of all types of axles.
The reason-why of the internal gear drive principle is quickly and simply explained in our booklet "Twelve Talks to Engineers," which we will send you free. Write for it.

CELFOR TOOL COMPANY, Buchanan, Mich.



A·B·C

NUMBER 419

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H. L. Rogers

Have You a Ford?

The RAJAH for FORDS

—or a Buick, Dodge, Winton, Chalmers, Oakland, Oldsmobile? For all of these and many other cars, there are

SPECIAL

RAJAH

PLUGS

You never will know complete plug satisfaction until you put them in your car. Made from the same materials and with the same skill that have won for Rajah Standard and Rajah Giant Plugs the preference of three-quarters of the Race and Test Drivers. Furnished with thumb-nut or stud terminal if required. All good dealers or by mail.

RAJAH AUTO-SUPPLY CO., Bloomfield, N. J.

John Millen & Son, Ltd., Montreal, Toronto, Winnipeg, Vancouver

Electric Auto-Lite

Starting—Lighting—Ignition

Electric Auto-Lite equipment for automobiles is as famous for the service that backs it as for the reliability and economy of its operation.

ELECTRIC AUTO-LITE COMPANY

Home Office and Factory: Toledo, Ohio

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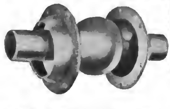
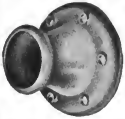
BOSSERT



In the most perfect plant that brains, money and experience could devise, we have the men and equipment to produce pressed steel parts in any quantity on comparatively short notice. We make more than 200 pressed steel parts and you can make your vehicles lighter and at lower cost, without sacrificing strength if you use *pressed steel* spring hangers, running boards, brake drums, etc., instead of malleable iron, steel castings and drop forgings.

"THE BOSSERT WAY"

stands for the prompt delivery of your order filled in accordance with every item of the specifications.



The Bossert Co.

UTICA

N. Y.

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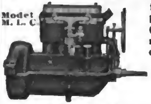

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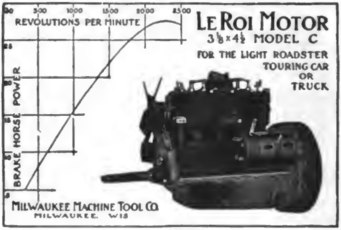

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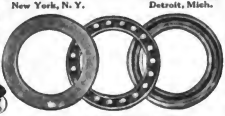

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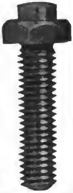

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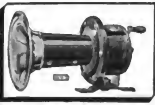

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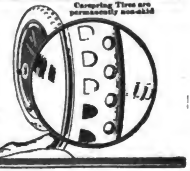

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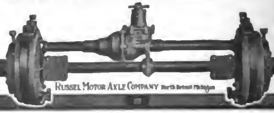

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successfully resist road wear and give Long Mileage

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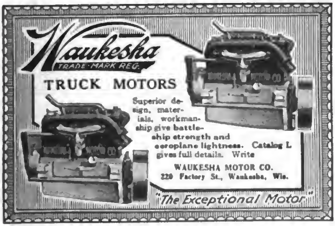

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"The Exceptional Motor"

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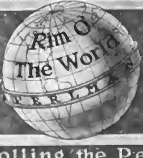

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Studebaker 35 radiators	$22.50
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32 x 3½ Kelsey No. 20 clincher	2.30
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Our Guarantee Is Permanent —Our Reputation Established

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bought at a tremendous discount at an excess sale of one of the country's best known manufacturers. All fresh selected stock—standard make, at prices you can't afford to overlook.

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30x3½	8.00	2.25
31x3½	8.50	2.50
32x3½	9.00	2.50
34x3½	9.50	2.55
36x3½	10.75	2.75
31x4	11.75	2.90
32x4	12.50	3.20
33x4	12.75	3.25
34x4	13.25	3.35
35x4	13.50	3.45
35x4½	17.00	4.15
36x4½	17.50	4.25
37x4½	18.00	4.35
35x5	17.50	5.00
36x5	18.50	5.00
37x5	20.00	5.20

Add 10% to the above prices for non-skid

Special Bargains in Slightly Used and Demonstrating Tires

Size	Used Tires	Used Tubes
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30x3½	4.25	1.45
31x3½	4.50	1.50
32x3½	5.25	1.50
34x3½	5.50	1.60
31x4	6.25	1.65
32x4	7.00	1.60
33x4	7.25	1.70
34x4	7.75	1.70
35x4	7.50	1.75
35x4	7.50	1.75
36x4	7.50	1.75
34x4½	8.00	1.75
35x4½	8.00	1.80
36x4½	8.25	1.85
37x4½	9.50	1.90
35x5	8.50	2.00
36x5	9.50	2.00
37x5	9.75	2.20

We guarantee all tires sold by us at the above prices to be free from imperfections in material and workmanship. Send one dollar deposit with each tire ordered. Tires will be sent promptly C. O. D., with privilege of examination. Specify style of rim to avoid delay.

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Bosch D 4 cyl. high tension variable spark	20.00
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Mea 6 cyl. high tension dual with coil	40.00
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All Service Parts for All Cars

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Write our sales department about your requirements.
Manufacturers for the Trade

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THE SUCCESS of the AutoPartsCo.

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2-ton truck frames, new..........each	32.50

We also have many other style frames in stock. Write for price and measurements.

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D 4 dual	40.00
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Our Magneto Department is equipped to handle all repair jobs at low prices.

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Of 50% to 75%

Our Assortment includes wheels, axles, gears, bearings, cylinders, pistons, crank cases, transmission cases, etc., for nearly all standard makes of cars. Get our prices before placing your order.

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We save you 50% to 75%.

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Bosch Magnetos sold with six months guarantee
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DAYTON AUTO REPAIR CO.
355 West 52d Street New York City

ALL TYPES OF BEARINGS
The New Departure Service Stations

THE GWILLIAM COMPANY
Engineers—Specialists in Bearings
Bearings for Orphan Cars
New York, 2 Columbus Circle (58th St. at Broadway)
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USED PARTS 50% DISCOUNT

Following cars: Chalmers, K-F-M, Flanders 20, two and three speed; Buick 10-16-17-19-21 & E. M. F. 30; Maxwell AA-E-K-HD-CA. Overland 38 to 59. Transmissions, axles, wheels, bearings, crankcases, connecting rods; in fact, almost any part for any make of car.

AUTO SALVAGE CO., INC.
1414 Main St. Kansas City, Mo.
(Oldest and Largest used parts company)

When in Need of Any

GEARS, SPRINGS, BEARINGS

or any other part of a car, try us
We carry a complete stock of SUPPLIES also

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1827 McGee Street KANSAS CITY, MO.

PARTS

FOR ALL MAKES OF CARS
ALWAYS ON HAND

We can fill your orders promptly. Requirements for any make of car supplied.

EDWARD'S GARAGE
(Edward Cavanagh)
285-287 Morris Ave., N. Y. City,
Near 138th St. and 3rd Ave.

MY PRICES ARE RIGHT

We have second-hand motors for every make of car for $25.00 and up.
We also carry a complete line of
Cylinders @ $5.00 each
Crank Shafts @ $10.00 each
Rear Ends @ $25.00 each and up
No matter what you need, let us quote you a price that will save you from 25% to 50%.

The Guy Auto Exchange
Montclair, N. J.

S-P-R-I-N-G-S

We make and repair springs for all cars and trucks. Special scientifically heat-treated. Highest grade. Write and tell us what you need and get our prices. Quick shipment.

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from Clearing House ads, "quick action, our motto," advertise and create business by the shortest route.

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Let us hear from you
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NEW ROADSTER BODIES FOR FORDS 1916, with Top, Windshield, F.O.B. cars, $30.00. Speedster—Cloverleaf—seven passenger Jitneys and Commercial Bodies. Com. Fenders $4 pair.

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We have on hand a miscellaneous lot of PARTS for every make of car.

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AMERICAN UNDERSLUNG AND NYBERG RIDER-LEWIS
Parts and Repairs for all Models

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FOR SALE
Peugeot Race type cylinder heads for Fords 16-overhead valves, Rocker arms and Push Rods, Special intake manifold, 1¼" carburetor, $50.00 F.O.B.

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FORD REPAIRING OUR SPECIALTY

Guaranteed work. Lowest prices and immediate service. Let us prove it on your next repair job.
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LARGEST BECAUSE BEST

Send for Price List

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351 West 52nd Street
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CYLINDER GRINDING

Special Light Alloy Pistons

Our special facilities enable us to do highest grade work.

Over 225 Piston Patterns

AUTO ENGINE WORKS
St. Paul Minn.

AAA SCORED CYLINDERS

Repaired by patent electric process. Filled with a silver and nickel alloy. Eliminates grinding. No warping or enlarging of cylinder bore. Same piston and rings used. Reshipped 24 hours after received.

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Rebored and Ground

with special equipment, assuring absolute accuracy.
NEW PISTONS
Cast iron and magnalite aluminum.
PISTON RINGS
High compression and plain.
Charges Reasonable—Prompt Delivery.

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Send Your Broken Parts to Us. We can Match Them at Less Than ½ Original Cost. All makes carburetors, magnetos, bodies. **Parts for All Kinds of Cars.** Springs, Wheels, Shock Absorbers, Lamps, Cushions, Gas Tanks, Generators, Mufflers. **We Have Them for $1.00.** Write us. **SATTLER**
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ALUMINITE PISTONS

Aluminite Pistons will put six-cylinder smoothness into a four-cylinder motor, give more power and quicker getaway. In asking prices, state make, model and year. EXPERT MOTOR BUILDING—**Piston Rings, Cylinder Grinding, also Piston Pins, Aluminite Connecting Rods and Racing Motors.**

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Pistons, Rings and Wristpins made to fit. All work guaranteed. Write for information and quotations.

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We Rebore Cylinders and equip with our **Eclipse** rings and extra high quality pistons, insuring a correct fit and giving extra efficiency to your motor. Give us a trial. Prices interesting.

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Cylinders, crankcases and crankshafts welded

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Will increase speed and power, reduce vibration and eliminate carbon trouble. We are the first in New York to offer these pistons to motorists. **Get our prices on regrinding cylinders and for ALUMINUM ALLOY PISTONS.**

Oversize Pistons, Pins, Rings and Bushings.

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STOP That Knocking and Vibration
LOOK To the Saving of GASOLINE

LISTEN TO YOUR MOTOR

Your auto cylinders may need reboring and new pistons and rings made. Manufacturers acetylene welding and cutting and carbon consuming apparatus. We weld and braze any metal that melts.

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By experts on Heald Grinder. All pistons, rings and wrist pins ground mechanically perfect. All patterns and sizes in stock. Write for quotations.

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WE REGRIND CYLINDERS

furnish our heat-treated piston rings and pistons. First class equipment; 15 years' experience. Write for our prices.

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fitted with light pistons and LEAKLESS RINGS.

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reclaimed with our new silver process without over-size pistons and rings. All castings welded. Work guaranteed or money refunded. Oxy-Acetylene Welding.

McCREA & JONES, 30 Catherine St., Utica, N. Y.

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We make new pistons, rings and pins. Regrind crankshafts. Fully equipped Machine Shop with Hydraulic Press. Expert workmen. All work guaranteed. **H. S. Anderson Auto Repair**, 211-219 N. Sheridan Ave., Pittsburgh, Pa.

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Bodies and Equipment. Tops. Expert mechanics. Dead storage.

All work guaranteed. Let us estimate.

JOHN J. MADDEN
(formerly with Healy & Co.)
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Best Rebuilt Tires
At ¼ Price

Will Run 5,000 Miles and More

These tires are of double thickness and have 12 plies of fabric; therefore no punctures, no blowouts. They are rebuilt by our special process, vulcanized and double treaded.

30x3....$4.50	32x3½..$5.75	34x4....$7.75
30x3½.. 5.50	33x4.... 7.50	36x4.... 9.00

Send $1 deposit for each tire ordered, and we will send the tire, balance C. O. D.

CHICAGO D. T. CO., Mfrs.
1233-37 Wabash Ave. Chicago

DOUBLE SERVICE TIRES
Guaranteed 3500 Miles

Size	Plain	Tubes	Size	Plain	Tubes
30x3	$5.00	$2.05	36x4	$9.00	$3.80
30x3½	8.00	2.40	36x4½	10.00	4.00
33x4	8.00	3.45	36x5	11.00	3.45
34x4	9.00	3.60	37x5	11.00	5.55

Non-skid Tires, all sizes, $1.00 Extra.
State if Q. D. straight bead or clincher type.
15% Deposit required on all C. O. D. orders.
Discount of 5% when cash accompanies order.

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ATTENTION

We have just purchased hundreds of these tires far below market price and give you the benefit of this

GREAT REDUCTION

New, Guaranteed Fresh Stock Tires and Tubes Sacrificed

Size	Price
32 x 4	$10.55
34 x 4½	14.15
35 x 4½	15.35
36 x 4½	15.40
35 x 5	16.90
36 x 5	17.15
37 x 5	18.15
37 x 5½	23.90

10% more for non-skid.

Where else can you procure such bargains? Our name and reputation protects you. Come in and investigate.

One dollar or sufficient to defray express charges required with each order. Shipments made promptly C.O.D., subject to your inspection.

Auto Sales & Parts Co.

1602 So. Michigan Ave., Chicago, Ill.

"IDEAL"
DOUBLE TREAD TIRES
Now Known and Proven

to be the best double-tread tire on the market.

LIBERALLY ADJUSTABLE ON A 4,000-MILE BASIS

Our tires are relined so no stitching on inside can injure your tubes.

Size	Price	Size	Price
28x3	$4.75	35x4	$9.85
30x3	5.25	36x4	10.50
30x3½	6.50	34x4½	10.95
31x3½	6.90	35x4½	11.20
32x3½	7.35	36x4½	11.75
34x3½	8.00	37x4½	12.20
31x4	8.25	35x5	12.85
32x4	8.75	36x5	13.00
33x4	9.20	37x5	13.45
34x4	9.50	38x5½	13.60

NO PUNCTURES; NO BLOWOUTS; NO TIRE TROUBLE

The above are almost entirely eliminated from these tires.

THIS IS NO IDLE BOAST. A TRIAL ORDER WILL CONVINCE YOU.

One dollar or deposit sufficient to defray express charges required with each order. Shipments sent promptly C. O. D., subject to your inspection.

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ACORN TIRE CO., INC.
1547 Michigan Ave.,
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We can save you money on all Standard Brand Tires.

Write for Special Prices.

NEW BLEMISHED TIRE BARGAINS

(3,500-Mile Guarantee)

30x3	$6.00	34x4	$12.50
30x3½	7.50	36x5	17.00

We Double Tread your old tires and guarantee perfect satisfaction. Give us a trial.

For recovery, 30x3..$4.00 30x3½..........$4.50
34x4........$6.00
Non-Skid 10% Extra.

UNEEDA TIRE CO.
262 Halsey St. Newark, N. J.

TIRES

Spend the Winter in the South FREE OF COST.

Any intelligent man with a few hundred dollars can do this by investing in Akron Tires

Size	Plain	Non-Skid	Tubes
28 x 3	$5.25	....	$1.80
30 x 3	5.50	$6.75	1.90
30 x 3½	6.95	7.50	2.15
32 x 3½	7.95	8.75	2.25
34 x 3½	8.85	9.75	2.35
31 x 4	9.65	10.00	2.95
33 x 4	9.85	10.85	3.10
34 x 4	9.95	10.95	3.20
36 x 4	10.95	11.95	3.35
35 x 4½	12.95	13.95	4.10
36 x 4½	13.50	14.50	4.15
37 x 5	15.95	16.95	5.05

AKRON TIRE CO., Inc.
Authorized Capital, $300,000.00
1789 Broadway, Corner 58th Street, New York
Tel. Columbus 9441

FORD SIZE TIRES

30x3½ Non Skid, First Grade

Mileage Guarantee Removed

—$6.50 EACH—

JANDORF AUTOMOBILE CO.
1761-3 Broadway, 303 W. 59th St.,
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Reduce Your Tire Bills
by using our
DOUBLE TREAD TIRES

30 x 3½........$6.00 34 x 4..........$8.00
36 x 4½........$10.00

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Supplies and Accessories

HAND-I-WASH

COMBINATION
Soap—Water—Towel

Everything necessary to a thorough cleaning of the hands after a roadside repair.

An ingenious, compact cylinder containing a metal tube filled with antiseptic washing fluid and roll of sanitary, absorbent paper towels. Enough for 50 washes and costs 1 to 2c. a wash. Easily refilled.

Everybody wants one—nearly every motorist buys one.

A big business for the supply dealer at a liberal profit. Get a stock now. They sell on sight.

Send for details of our dealer proposition.

List Price $1.00—Refillers (Fluid and Towels) 50 Cents (Prepaid)

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M'f'ng Chemists
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WORLD'S LARGEST SUPPLY HOUSE

Our stock of supplies and accessories is the largest in the world. We can supply you with everything you need at prices that are away below what you are paying.

Stromberg and Schebler carburetors, springs, transmissions, axles, motors, bodies, radiators, steering gears, magnetos, coils, horns, etc.

Money cheerfully refunded on anything that is unsatisfactory.

Our PRICE WRECKER catalogue contains 3,000 big bargains—GET A COPY.

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Largest Automobile Supply House in the World.
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for Xmas tree lights, trains and Electric toys

Dealers solicited.

General Lead Battery & Electric Co.
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For Winter Driving

FROST KING RADIATOR PROTECTOR

Prevents radiator from freezing. Saves gasoline—Corrects winter troubles. Keeps driver warm. Why use newspapers, cardboard or other unsightly covers instead of this attractive metal shield? Adjustable and easy to attach or detach. Price $4-$10. Ask your dealer or **Mecca Machinery Co.**, 83 Adams St., Brooklyn, N. Y.

Magneto—Service Stations

MAGNETO

S Bosch (High Tension), $20.00 to $40.00
P Bosch (Dual Systems), $20.00 to $50.00
E Eisemann (Low Tension with Coil), $15.00
C Eisemann (High Tension), $20 to $45.00
I Remy (with Coil), $20.00
A Splitdorf (with Coil), $15 to $30.00
L PARTS FOR ALL MAGNETOS ALWAYS IN STOCK
WE REPAIR STARTER—MOTORS GENERATORS—MAGNETOS
In fact anything in the ignition line.

MEINERT MAGNETO SPECIALTY CO.
1216 Prospect Ave., Cleveland, Ohio

M-A-G-N-E-T-O-S

Expert repairing on all makes of magnetos.

All types of Magnetos BOUGHT AND SOLD

MAGNETO SALES COMPANY
1777 Broadway New York City

MAGNETOS

EVERY MAKE IN STOCK
EXPERT REPAIRING. QUICK SERVICE
Get Our Price Bulletin

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BOSCH MAGNETOS

All types of slightly used magnetos at your price, guarantee them right.
Your money's worth or your money back.

E. W. SAUNDERS,
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Self-starting and Lighting System Repairs

See our Mr. Crilly about all your electrical difficulties
Delco Repair Co., 244 W. 49th St., N. Y. City.

MAGNETO, COIL & STARTER REPAIRS, Specialists on this work. Our facilities guarantee perfect service and prompt delivery. Parts for all magnetos carried in stock.

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64 Goddell Street Buffalo, N. Y.

Magnetos, Starters and Generators promptly repaired by experts. Factory parts carried in stock. Service Station for Bijur and North East apparatus and U. S. L. storage batteries.

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Portable Garages

PORTABLE GARAGES $65. Heaviest steel; no wood; absolutely fireproof. Anyone can put up or take down. Send for catalog.

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PORTABLE GARAGES and BUNGALOWS We are the largest manufacturers of portable all steel garages. We also manufacture wooden garages, bungalows, boat houses, factories, schools and churches.

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THE STEWART AUTOMOBILE SCHOOL

teaches you thoroughly everything you should know about an automobile —how to run one—how to repair one —how to find trouble and cure it.

Various parts of different makes are used in actual demonstration. We require every student to do the work personally and educate his hands, ears and eyes, as well as his mind.

Day and Evening Classes

STEWART AUTOMOBILE SCHOOL
225 West 57th St. New York
AT BROADWAY

LEARN HOW

to drive your own car and how to repair it in the best equipped Automobile School in the United States. A thorough course of instruction for owners and men desiring to enter the automobile industry as chauffeurs, repairmen or mechanics. Satisfaction guaranteed. Write for free booklet.

West Side Y. M. C. A. Automobile School
321 West 57th St., New York

FREE BOOKLET

"How to Succeed in the Automobile Business," on application—$40,000 equipment—eight instructors—actual work, repairing and driving—Day and evening classes. **Greer College of Motoring**, 1456 Wabash Ave., Chicago.

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Absolute Satisfaction is OUR AIM

GUARANTEED RADIATOR REP. IS OUR PROOF.

We maintain 24 Hr. shipping service.

Ohio Service & Rep. Co.
2618 Detroit Ave., Cleveland, O.

CHEAPEST, QUICKEST RADIATOR REPAIR SERVICE IN THE COUNTRY

All work guaranteed

AUTO RADIATOR REPAIR CO.
1230 Payne Ave., Cleveland, Ohio

RADIATORS

Most Durable and Efficient.
Make New Radiator, allow for old one.
PRICES RIGHT.

Todd Manufacturing Co.
820-24 Mary Pl. Minneapolis, Minn.

RADIATORS Making and repairing radiators and fenders, frozen, leaky and damaged radiators repaired no matter how bad they are, at very low prices, each radiator repaired by us given a written guarantee for six months. PARK SQUARE RADIATOR CO., 41 Columbus Ave., Boston, Mass.

RADIATORS

Fenders, Tanks, Lamps, Repaired in 24 Hours.
All work guaranteed.

FRANCO-AMERICAN LAMP CO.
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COLUMBIA LAMP WORKS

We make and repair Lamps, Radiators, Cowls, Fenders and Hoods. Plating and Enameling done.

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Between 53d and 54th Sts. New York City

RADIATOR REPAIRS—Lowest prices; prompt attention to all orders. Hoods, fenders, tanks and windshields made and repaired. Most efficient shop in Greater New York. Work called for and delivered. **The United Auto Radiator & Lamp Shop, Inc.**, 858-862 Bedford Ave., Brooklyn, N. Y. Phone 958 Williamsburg.

Business Opportunities

TO MANUFACTURERS

We are open for a good line to sell to Automobile wholesale trade.

Auto Appliance Co.
1960 Broadway, New York

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MECHANICAL EQUIPMENT

FOR THE GARAGE IS OUR SPECIALTY

Northern Cylinder Grinder. Valve seat reamers. Valve Grinders. Valve Refacing Tools. Engine Lathes. Drill Presses. Air Compressors. Chain Blocks.

Send for catalogue.

NORTHERN MACHINERY COMPANY
503 South Sixth St., Minneapolis, Minnesota

FOR SALE

BRYANT THREE SPINDLE CHUCKING GRINDER (like new)
CLEVELAND 2¼" AUTOMATIC SCREW MACHINE (latest type)

We also buy new and used machine tools.

NEW JERSEY MACHINERY EXCHANGE
21-23 Mechanic Street NEWARK, N. J.

Miscellaneous

FOR SALE

The latest improved type Olsen Torsion Testing Machine

It is a 230 inch pound capacity, No. 2 direct motor drive, autographic attachments so that three poises, curves in three phases can be obtained. It is equipped with chucks for bars up to 2¼" in diameter, also special chucks for base rails long enough for 10-foot bases.

Building re-construction makes it necessary for us to dispose of it. The price and delivery cannot be duplicated today and the machine has never been used.

If you are interested, we can make you an attractive proposition.

HUDSON MOTOR CAR CO.
DETROIT, MICHIGAN

DEALERS: Do your own monogramming with our transfer letters. They are durable, artistic, easily applied and always ready. Catalog on request.

MOTORISTS' ACCESSORIES CO.
Mansfield, Ohio

Motorists' Clothing

MUSKRAT LINED OVERCOATS

Black broadcloth outside, lined with finest selected muskrat skins, beautiful large Persian lamb collar, double breasted, 50 and 52 inches long, sizes 36 to 46, ready for delivery. A limited quantity of these handsome garments to close out, price

$35.00

Regular retail price $75.00. Direct from manufacturer. You save all middlemen profits and take no risk.

Sent for Examination

EXAMINE AND TRY ON before paying. Write today, stating chest measures, height and weight. Enclose 50c. for express charges only, and coat will be sent at once.

E. HART, Dept. J. 518 West 134th Street, NEW YORK CITY

Cars for Sale—Wanted

Matheson

Cars and Repairs Parts

Frank F. Matheson Wilkes-Barre, Pa.

$400.00
WINTON 6-48
Overhauled, Painted, Guaranteed
Fully equipped. Good tires
J. W. McColpin
2357 W. Pico St. Los Angeles, Cal.

Electric Starting and Lighting

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The AUTOMOBILE

Vol. XXXV
No. 22

NEW YORK, NOVEMBER 30, 1916

Ten cents a copy
Three dollars a year

Maud L'Anphere Crook

It Is Easy To Sell The
HUDSON SUPER-SIX

The Largest-Selling Fine Car in the World
Holder of all Worth-While Endurance Records

To December 1st the 1916 consumer deliveries will have totalled 25,000.

There was a time last summer when dealers in less *wanted* cars did a thriving business. Such dealers are apt to have misjudged then the importance of having the right car in effecting their sales. For all must recognize the Hudson Super-Six as the most *wanted,* easiest selling car above $1000.00 the industry has known.

No car has ever established such records. No car has ever proved such superiority.

Now that the season is past, when dealers in other cars are not doing so well, haven't you noticed that Super-Six sales still exceed Hudson production? October and November retail deliveries exceed those of June and July. That they are not larger is due solely to the limit of the factory production. Dealers should not overlook the importance of their having a *wanted* car. If they must "sell every car they handle, the business cannot be profitable."

HUDSON MOTOR CAR COMPANY
DETROIT, MICHIGAN

We do not advertise for dealers to make up the Hudson organization. We are too particular in our choice to rely upon such a manner of recruiting the kind of men we want in this organization. But we do want to meet real automobile merchants. Perhaps sometime our acquaintance may be of mutual advantage.

HUDSON SUPER-SIX

Editorial Contents, Page 3

Advertisers' Index—Next to last page

Stewart Products

Stewart Speedometer

$25

$1

Stewart V-Ray Spark Plug

Chase the Winter "Bug-a-boo"

It exists in memory only. It's a thing of the past. The dull-winter-business period of previous years is dead. Let's bury it—then forget it.

Get a new grip on your business. *Believe* as other live dealers *know* that there will be a *big* winter business this year.

More cars will be in use *this winter* than were driven in the summer two years ago. At least 75 per cent of the cars will be in constant service.

This means that there is a *big winter* business for you if you will only go after it.

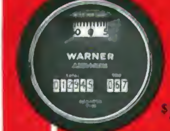
And don't forget, Stewart Products will sell faster than ever. Each Stewart Product is a real necessity for the car in winter as well as summer.

"It will pay you to see that every car is Stewart equipped."

STEWART-WARNER SPEEDOMETER CORPORATION
CHICAGO, U. S. A.

$6

Stewart Motor Driven Warning Signals

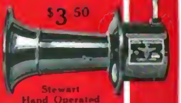


$50

Warner Auto Meter

Stewart Vacuum System

$10

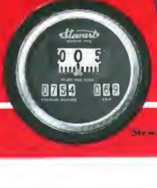


$3 50

Stewart Hand Operated Warning Signal

$12

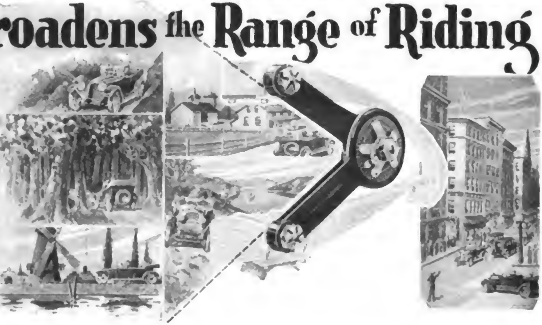
Stewart Tire Pump



$10

Stewart Speedometer for Fords

Broadens the Range of Riding



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231—241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, NOVEMBER 30, 1916 No. 22

Important Trade News of the Week........907-917

Editorials 918

Electric Systems Simpler......................919

New Cabriolet for Oldsmobile..................924

Denmark—A Good Car Market.....................925

Smooth Lines in Moon Closed Models...........928

Many Factors in Brake Design..................929

Alcohol, the Fuel of the Future...............932

Piston Progress Illustrated...................934

Constant Pressure Cycle Efficient.............935

The Automobile Industry in Switzerland........937

The Engineers' Forum..........................939

Canadian Truck Good Production Design........940

Westinghouse Welfare Work.....................942

Accessories 945

Industrial Miscellany.........................947

Automobile Calendar...........................947

INDEX TO ADVERTISERS......112-113

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South Bend, Ind. Detroit, Mich. Walkerville, Ont.

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 30, 1916—CHICAGO NO. 22

Hydraulic Steel Co. Refinancing

Plans $10,000,000 Co.—Standard Oil Interests Back of Reorganization

CLEVELAND, OHIO, Nov. 27—The Hydraulic Pressed Steel Co., one of the largest producers of pressed steel wheels, frames and forgings, has a plan under consideration with the Standard Oil Co., which provides for the formation of a $10,000,000 company which will include the Hydraulic company and one other. Under this plan the holders of the Hydraulic common will receive approximately $108 cash for each share plus $162 par in the stock of the new company. By the deal this would mean a withdrawal of part of their investment in cash by sellers of the Hydraulic stock while the balance would remain in the company as now.

The management would undergo virtually no change and the board of directors would include Clevelanders and representatives of the country's leading financial interests. The Hydraulic company would continue to manufacture its present lines, according to the plan, and would enlarge its output.

This company was organized in 1906 and its production has amounted to $7,000,000 yearly.

Farr Leaves SKF Bearing Co.

HARTFORD, CONN., Nov. 28—A. V. Farr has become sales manager of the Hess Steel Corp., Baltimore, Md. He was formerly advertising manager of the SKF Ball Bearing Co., this city.

Herschell-Spillman Adds New Model

NORTH TONAWANDA, N. Y., Nov. 28—The Herschell-Spillman Co., whose motors now are used in a large number of passenger cars and commercial vehicles, is shortly to bring out a new model. It will be a 3¼ by 5 motor, of L-head design, for commercial vehicle and small car use. The present capacity of the plant is from 15,000 to 20,000 of these motors a year. Details of the new motor are at present being worked out by Designer E. O. Spillman, and it is hoped to have samples ready by Jan. 1.

Schoeneck to Make One Chassis

CHICAGO, Nov. 27—The Schoeneck Co., of which J. Alvin is president, will produce one chassis equipped with four body models. These are two, four, six and seven-passenger types. The car is equipped with a 4 by 5½ in. six-cylinder Herschell-Spillman motor, other equipment including a Brown-Lipe four-speed gearset, Brown-Lipe disk clutch and Timken axle. The wheelbase is 139 in. and tires are 34 by 4½.

Schaaf with Fisher Tractor Interests

INDIANAPOLIS, Nov. 27—A. R. Schaaf, for many years secretary of the Fiat Automobile Co., Poughkeepsie, N. Y., and previous to that connected with the Pope Mfg. Co., Toledo, Ohio, has united with Carl G. Fisher in the manufacture of a farm tractor and will associate himself with that organization in the capacity of factory manager.

Pfeffer to Retire from Chalmers

DETROIT, Nov. 28—C. A. Pfeffer, vice-president and assistant general manager of the Chalmers Motor Co., this city, will retire shortly from that company to enter into business for himself. He will remain, however, as a stockholder and director.

Hibbard Is Regal Asst. Sales Mgr.

DETROIT, Nov. 27—V. S. Hibbard has joined the Regal Motor Car Co. as assistant sales manager. Mr. Hibbard was formerly sales and advertising manager of the R. C. H. Corp.

Oct. Truck Exports Smaller

Drop Nearly $2,000,000 in Value—Passenger Cars Gain—Total $9,341,119

Mos.	Cars	Value	Trucks	Value	Parts
			1916		
Oct.	..4880	$3,756,768	1144	$3,635,291	$1,949,060
Sept.	.3585	2,819,405	1835	5,203,215	2,095,188
			1915		
Oct.	..3479	2,749,255	1596	4,307,190	1,819,950

WASHINGTON, D. C., Nov. 27—The feature of the export trade in October was increased exports of passenger cars and parts with a diminution of exports in commercial cars. Figures just announced by the Department of Commerce show that during October last there were 1144 commercial cars, valued at $3,635,291, and 4880 passenger cars, valued at $3,756,768, together with parts to the value of $1,949,060, exported to various foreign countries. For the corresponding month of last year the figures were: Commercial cars, 1596, valued at $4,307,190; passenger cars, 3479, valued at $2,749,255; parts, not including engines and tires, $1,819,950.

During the 10 months of 1916 the figures show that 15,917 commercial cars, valued at $44,006,346, and 51,699 passenger cars, valued at $36,049,497, together with parts, not including engines and tires, to the value of $20,091,793, were shipped abroad. During the same period of last year the commercial car exports numbered 18,865 machines, valued at $52,076,406 and passenger cars to the number of 34,515, valued at $29,543,227. The exports of parts, not including engines and tires, were valued at $12,814,809.

The big buyers in October last were as follows: France, 522 cars, valued at $1,782,088; United Kingdom, 684 cars, valued at $1,687,152; Canada, 1021 cars, valued at $718,962; West Indies and Bermuda, 665 cars, valued at $505,198.

Knickerbocker Co. Reorganized

Larger Output—Capital Is $500,000—To Add Tractors to Truck Line

NEW YORK, Nov. 24—The Knickerbocker Motors, Inc. has been incorporated in this city to take over the Knickerbocker Motor Truck Mfg. Co., which for several years has made trucks in New York City. The new corporation is essentially a reorganization of the old concern on a broader scale and contemplates the production of 500 chassis the first fiscal year.

H. G. Streat, president of the Streat Coal Co. and founder of the Knickerbocker Motor Truck Mfg. Co. is president; A. C. Brady, formerly president of the Brady-Murray Motors Corp., Chandler dealer in New York City is vice-president and sales manager; H. G. Streat, Jr., son of the president, is treasurer; and W. C. Guilder, formerly production manager for the Kelly-Springfield Motor Truck Co., designer of the first Garford trucks and early Macks, and also production man with the Timken-Detroit Axle Co., is production manager.

Mr. Streat, Clarence A. Ludlum, Charles H. Class, W. H. Bonynge and Grove D. Curtis are the directors.

The products will be a 2½-ton truck, a 5½-tonner and a 3-ton tractor. Two hundred of the 2½-tonners, 100 of the 5½-tonners and 200 tractors are expected to make up the first year's production.

The concern has an authorized capital of $500,000, all common, $10 par value per share. In a statement by W. A. Lewis and J. B. Linn, underwriting managers it is stated that $250,000 of this stock will be placed on the market, to be held until it is all paid for, subscribers receiving receipts to be held until it is all subscribed. If, after a reasonable time the stock is not all subscribed, the full amount paid in by subscribers will be returned. It is also stated that none of the capital thus raised will be used for promotion; but will all be devoted to the conduct and expansion of the business.

The concern will occupy the old plant of the Knickerbocker company at 151st Street and River Avenue, Bronx, New York.

Race Gillette Tire Sales Manager

EAU CLAIRE, WIS., Nov. 25—C. G. Race, until now general manager of the Chicago branch of the Gillette Safety Tire Co., this city, has assumed the position of general sales manager and a director of the Eau Claire concern. Further, the entrance of eastern capital into the company has caused it to increase its authorized capital from $250,000 to $1,000,000. As soon as possible, the second unit of the new tire and commercial rubber goods plant just completed will be undertaken, and by March 1 or April 1 the capacity will be more than doubled. Within a year it is hoped to increase the output to 1000 tires a day. R. B. Gillette, founder of the concern, continues as general manager.

Wilson Adds 1-Ton Model

DETROIT, Nov. 27—Smaller than the 2-ton single chassis upon which the J. C. Wilson Co. of this city has heretofore specialized, but incorporating the same general features of design, a 1-ton model of Wilson truck has just been placed on the market. The new model rounds out the line more than is at first apparent, since with tractors made by shortening the wheelbases of these two models it is possible to embrace practically all load capacities from 1 to 6 tons.

Smith Truck-Forming Attachment for All Cars

CHICAGO, Nov. 27—Additional capital brought about through the re-organization of the Smith-Form-A-Truck Co., and the taking over of this concern by the newly formed Smith Motor Truck Corp., is to make possible the extension of this particular truck-forming attachment to cars other than Fords. Already attachments are being made for such cars as Dodge, Maxwell, Buick, Overland and Chevrolet. The new unit for application to other cars will be known as the Universal, although this term does not have its usual meaning since units under this name will not apply to all cars for some time.

Attachments for Maxwell and Chevrolet have a frame of 4-in. channel section, the same as the unit for Fords and they sell at the same price as the Ford attachment or $350. This unit will convert this car into a 1-ton truck, but the larger size, the frame of which will be 5-in. channel section, will be designed for loads of 1500 lb.

Capacity for production of the attachment that has been made for Ford cars for the last 2 years is now 300 a day, and as announced last week, additions to the plant will be built which will practically double the floorspace and thus the company expects to be able within 3 months to take care of any demand that may come for these units either for Fords or other cars. At present the company is making an average of one a day of the Universal attachment, but is unable to keep pace with the demand for this particular unit, dealers in some cities asking for them in carload lots.

The method of attachment for the newer units is the same as for the Ford; that is, the rear axle of the car is used as a jackshaft for chain drive.

Detroit to Be Aviation Center?

Signal Corps, Representing Army and Navy, Visits Detroit and Buffalo

NEW YORK CITY, Nov. 27—The interest of the government in having automobile manufacturers take up the problem of aeroplane manufacture was evidenced last week when the Signal Corps, representing the Army and Navy, visited Detroit, Buffalo, and some other points with the thought of establishing aviation training stations in at least Detroit and Buffalo. The government recognizes that the automobile manufacturers are well qualified to carry out all work of aviation design and manufacture. There is no better manufacturing organization to handle such work and it is for this reason that these two cities are being considered, Detroit because of its leadership as an automobile manufacturing center and Buffalo because of the volume of aeroplane manufacture at present carried on there.

May Buy Joy Field

With this object in view the government is considering the possibility of taking over in Detroit what is known as the Joy Aviation Field, which is the testing ground purchased some time ago by the Packard company. The matter is only under contemplation. Howard Coffin of the Council of National Safety, and also of the Navy Consulting Board, has been making the rounds with the Signal Corps in its investigating work.

Stout Is Packard Aircraft Manager

DETROIT, Nov. 24—W. B. Stout has been appointed manager of the aircraft division of the Packard Motor Car Co. Mr. Stout is at present general sales manager and advertising manager of the Scripps-Booth Corp. He will resign his present position on Dec. 2.

Brown Becomes Scripps Sales Manager

DETROIT, Nov. 24—W. I. Brown, who has been assistant sales manager of the Scripps-Booth Corp., will become the general sales manager Dec. 1. Mr. Brown joined the Scripps-Booth company after resigning from Dodge Bros.

Smith Blair Truck Sales Manager

NEWARK, OHIO, Nov. 24—G. E. Smith has become sales manager of the Blair Motor Truck Co., F. L. Swanberg has resigned as manager. The management of the factory will be in charge of J. P. McCune and F. O. Spaulding.

Two 1917 Studebaker Chassis

Four-Cylinder in Three Body Styles—Six-Cylinder Available in Six

DETROIT, Nov. 28—*Special Telegram*—The program of the Studebaker Corp. for 1917 will include a four-cylinder and six-cylinder chassis. These are known as series 18. Both of these chassis and the bodies are considerably refined and improved in the direction of greater comfort and convenience for the passengers. Fundamentally neither chassis has been altered. Among the important changes are a reversible seat, so that the passenger can face either front or back. Both front seats are adjustable for different leg lengths and on the backs of the front seats there are flexible leather robe straps. The tonneau is roomier because of a new design of auxiliary seats which fold under the rear seat, instead of against the back of the front seat. These new seats are armchairs.

Pistons Are Lighter

In the engine the pistons have been lightened, to some extent reducing vibration, and the oil pump has been re-designed to move a more positive oil feed.

Although the rear axle is quite similar to last year's Timken bearing design, it has been materially strengthened and in the electrical system the characteristics have been altered to give about 12 per cent greater starting torque. There is a new convertible top known as Every-Weather which fits to the touring body, providing a sedan when in place. Better equipment is provided, particularly in the way of Blackmore door curtain openers which permit the side curtains to open with the door; also Yale lock for the ignition switch.

In the four-cylinder model there will be a three-passenger roadster at $930, a seven-passenger touring car at $940 and a three-passenger landau roadster at $1,150.

On the six chassis there will be a three-passenger roadster at $1,170, a seven-passenger touring car at $1,180; a three-passenger landau roadster at $1,350, a seven-passenger touring sedan at $1,700, a four-passenger coupé at $1,750 and a seven-passenger limousine at $2,600.

Charter Oak Six on Market Next Spring

HARTFORD, CONN., Nov. 27—Early spring is the time at which the recently incorporated Eastern Motors, Inc., this city, expects to have the first Charter Oak car on the market.

The Charter Oak is to be an assembled proposition combining a Herschell-Spillman six-cylinder engine, a four-speed Brown-Lipe transmission and Timken axles. It is the desire of the Eastern Motors, Inc., to build the car in Hartford. A canvass of possible sites for a factory have availed little as yet.

Rumor has it that the concern may possibly locate in Waterbury. The sales department announces that dealers have been secured for the first year's output at least. The temporary executive offices and the engineering department are located at 1026 Main Street in the Pilgard building. The major portion of the stock is owned in Waterbury.

Grant Will Move Shortly

DETROIT, Nov. 24—The Grant Motor Corp. of Findlay, Ohio, will move to its new plant in Cleveland within the next two weeks. The company still has 300 cars to finish at Findlay and will start production before Dec. 1 in Cleveland with a schedule for 1,000 cars in December.

General Motors Opens Marquette Plant

DETROIT, Nov. 24—The old Marquette motor plant at Saginaw, Mich., has been opened by the General Motors Corp. to be used as a storage and transfer house this winter. The plant has been opened to facilitate shipment of Buick cars.

E. S. Swift an Overland Director

TOLEDO, OHIO, Nov. 24—E. S. Swift, vice-president of Swift & Co., Chicago, has been elected a director of the Willys-Overland Co.

Autocar Co. Elects Officers

ARDMORE, PA., Nov. 28—E. A. Fitts, formerly secretary and treasurer of the Autocar Co., this city, has been elected vice-president, and F. C. Lewin, formerly assistant secretary and treasurer, has been elected secretary and treasurer. J. C. Taney will take up Mr. Lewin's former duties. The other officers were re-elected, being D. S. Ludlum, president, and L. S. Clarke and W. W. Norton, vice-presidents.

Hoover ¾-Ton Delivery Car

YORK, PA., Nov. 27—A ¾-ton delivery car has been brought out by the Hoover Wagon Co., this city.

The engine is 3¾ by 4½ block cast design, cooled by thermo-syphon circulator through a cellular radiator. Ignition is supplied by a high-tension magneto with hand adjustable spark advance. The clutch is a three-plate design and the gearset has three speeds. Final drive is by shaft and two universals to a worm-driven semi-floating axle. Torque and propulsion being taken by the spring. Both springs are located on the rear wheel drum.

Four Companies To Raise Prices

Velie and McFarlan Cars and Riker and Chase Trucks Increased on Higher Cost

MOLINE, ILL., Nov. 27—The Velie Motors Corp., this city, will advance its prices $50 on the open bodies delivered on and after Jan. 1, 1917. Cars ordered and delivered prior to that date will be at the present prices, which are as follows: Model 28, $1,085 (with detachable sedan top, $1,285); four-passenger roadster, $1,085; two-passenger roadster, $1,065; model 27, $1,550. The closed models are excepted from the advance.

McFarlan Raises Prices $300

CONNERSVILLE, IND., Nov. 24—The McFarlan Motor Co., this city, will raise its prices $300 after Dec. 1. Touring cars and companion models will list at $3,500 and closed work will list from $4,600 to $5,300.

Riker Prices to Be Higher

BRIDGEPORT, CONN., Nov. 24—The Locomobile Co. of America on Dec. 1 will raise the prices of the Riker trucks. The 3-ton truck will sell for $3,600, an increase of $100, and the 4-ton truck will sell for $3,750, also an increase of $100.

Winton Continues Two Sixes

CLEVELAND, OHIO, Nov. 24—The Winton Co., this city, will continue its present models in 1917 without change, Model 33 selling at $2,485 and the 48 at $3,500. The company, however, may make an increase in its prices.

Chase Raises Some Prices

SYRACUSE, N. Y., Nov. 27—On two of the Chase models an increase of $75 in list price has been made. These are the 1-tonner, raised from $1,650 to $1,725, and the 1½-tonner, from $1,950 to $2,025. Other prices remain the same as before.

Start Work on Kelly-Springfield Plant

NEW YORK CITY, Nov. 24—Engineers will start work in the near future on plans for the new plant of the Kelly-Springfield Tire Co. at Cumberland, Md. The plant will cover about 75 acres. Ground will be broken early next spring. The completion of the new plant will mean a minimum increase of 400 per cent of the present capacity of that company.

$50,000,000 Business for Pontiac

Financial Outlook There Bright for 1917—Nine New Car and Parts Cos.

DETROIT, MICH., Nov. 25—A banquet held at Pontiac last Thursday night, promised the city the brightest and most prosperous financial future in its history. There were nine new companies engaged in the manufacture of automobiles and automobile parts represented who promised approximately $50,000,000 worth of business to the city for the coming year.

The Olympian Mfg. Co. employing 300 men with a weekly pay roll of $6,000 estimated $2,000,000 worth of business for 1917. The Oakland-Northway Co., employing between 1000 and 1500 men with a monthly payroll of $65,000 to $100,000, estimates business for the coming year at from $40,000,000 to $50,000,000. The Monroe Motor Co., employing 500 men with a payroll of $9,000 weekly estimates its next year's business at $4,000,000. The American Forging & Socket Co., employing sixty to eighty men, weekly payroll $1,200 to $1,600, estimates $430,000 in 1917. The Michigan Drop Forge Co., employing ninety-seven men, has a weekly payroll of $2,225 and estimates its business for next year at $388,000. The Columbia Truck & Trailer Co., employing fifty men with a weekly payroll of $1,500, makes an estimate of $4,000,000 in 1917. The Markley Handle Co., employing twenty-one men with a weekly payroll of $400, estimates its business for next year at $50,000. The Vanauken Blower Co. will employ from twenty to twenty-five men with a $500 weekly payroll and makes an estimate of $97,500.

Among those who responded to toasts were: R. F. Monroe, president of the Monroe Motor Co.; F. G. Clark of the Columbia Truck & Trailer Co.; R. A. Palmer, president of the Olympian Motors Co., and T. H. McDearmon of the Oakland-Northway Co.

Page Buggy Adds to Force

DETROIT, Nov. 24—The Page Bros. Buggy Co., Marshall, Mich., manufacturers of automobile tops, has recently doubled the working force of the organization and is in search of more men. The company is supplying the Briscoe Motor Co. and others with automobile tops.

Cole Heads Perfection Tire Co.

CHICAGO, ILL., Nov. 24—C. R. Cole has become president of the new Perfection Tire & Rubber Co. as a result of the recent merger of that company with the Champion Auto Equipment Co., Wabash, Ind., and the Perfection Tire & Motor Co., Niagara Falls, Ont. Arrangements have been made for the transfer of the assets and obligations of each company to the new company, which has taken out a charter under the laws of Delaware. The other officers of the new company are: Vice-president, R. J. Evans; secretary, C. W. Harris and treasurer, E. A. Stickelman. In addition to the officers, the directorate consists of the following: F. E. Humphrey, T. J. Moll, T. W. Cole, and H. M. Scambler.

Outside of the patents, the new company will have tangible assets of nearly $1,000,000 with less than $25,000 of liabilities.

Haynes Plans Increased Production

DETROIT, Nov. 24—The Haynes Automobile Co. has made plans for the purchase of machinery for a capacity of 100 cars daily. A new building will be erected with a capacity for three times as many cars as are made at present, and will have 600,000 sq. ft. of floor space. The company has 350,000 sq. ft. at present.

New Record for Delco Shipments

DAYTON, OHIO, Nov. 24—All former production records were broken last week in the plant of the Dayton Engineering Laboratories Co., this city. Though no figures were given as to the number of Delco systems shipped during the week, the former record was that ending Oct. 28, when 6836 systems were shipped.

Canadian Chevrolet Co. Expands

DETROIT, Nov. 24—Extensions are being made to the present plant of the Chevrolet Motor Co. of Canada, at Oshawa, Ont. The company has been manufacturing cars for a year and disposed of 8000 last year. Three new buildings are in process of erection and will give an added floor space of 277,075 sq. ft.

Hilts Enters Advertising Agency

DETROIT, Nov. 28—M. R. Hilts has resigned as advertising manager of the Puritan Machine Co., this city, to enter an advertising agency in Chicago.

Vincent Wheel in New Location

DETROIT, MICH., Nov. 24—The Vincent Clear-Room Steering Wheel Co., this city, has moved to 756 Woodward Avenue, the former offices of the Hyatt Roller Bearing Co. This company recently effected a reorganization by which E. H. Vincent became president and general manager; J. A. Martin, vice-president; H. H. Vincent, secretary and treasurer, and G. F. Burger, sales manager.

Detroit Electrics in Quantity

New Model $500 Lower Because of Standardized Design and Greater Production

DETROIT, Nov. 27—An entirely new Detroit electric has been brought out by the Anderson Electric Car Co., this city. The new model, known as 68, represents the initiation of a production policy for Detroit electrics. As a result of a greater increased production schedule the model 68 will sell for $500 less than its predecessor. This cut from $2,275 to $1,775 in the face of greater increased cost of materials represents the saving due to the installation of a large amount of labor-saving machinery and the adoption of a standardized chassis in which the number of options has been minimized so far as color and equipment is concerned. For instance, in upholstery there are three designs to choose from, while in painting there is one standard, whereas last year there was an unlimited field for either upholstery or painting. No sacrifice in material or workmanship has been made in any part in quoting the new figure.

The body is a brougham having a passenger capacity of four and is built on a chassis of 100 in. wheelbase with 56 in. tread. It has the standard Anderson motor with forty-two cells, thirteen-plate battery, giving a speed of 6 to 25 m.p.h. and a mileage of 75 to 100 on a battery charge.

100 Per Cent Business Gain

Officials of the Anderson company estimate at the present rate of increase the company's current year's business in electric passenger cars will exceed last year's by at least 100 per cent. The raw material for building the coming year's product has either been delivered to the plant or is under contract for specified delivery dates. The production of Detroit electric cars increased in 1916 over 1915 by 141 per cent, while the labor increase was not 100 per cent. This ratio is due to the introduction of a large amount of new machinery.

The first 4 months of this fiscal year show an increase of 79 per cent over last year.

The company has just erected in Detroit a new four-story service building of brick which has a capacity of 400 cars with repair and charging facilities and a large show and sales room.

Dort Director of Guaranty Securities

DETROIT, Nov. 27—J. D. Dort, president of the Dort Motor Car Co., has been made a director of the Guaranty Securities Corp. of New York.

ing Serious Error by Shipping Goods That Way

Buenos Aires, Argentina, Oct. 31—U. S. A. accessory manufacturers are making a serious error by sending accessories by parcel post to automobile dealers in Argentina. While the parcel post service is entirely satisfactory for such trade in the U. S. A. it does not work out satisfactorily here; in fact it is the most unsatisfactory way of sending small accessory parts to this country.

Recently a large dealer in Rosario had a typical experience with parcel post. An anti-glare equipment for headlights was sent from a U. S. A. maker and here is the chain of troubles the Rosario dealer had to solve:

"A few days after the anti-glare devices arrived I received an official card without stamp. I presented this at the post office which is only open from 10 to 12, that is that particular section of it. I was asked to call the next day and fortunately found the right man in. I presented the official card and was politely asked to go four doors away to get twelve centavo stamps on it (a centavo is approximately ½ cent, U. S. A. currency). On my return with this they looked a long time to find cards that had come with the parcels. I was sent with these cards to another place where I had to purchase sixty-nine centavo stamps, costing 35 cents. On my return with these and after waiting half an hour I tried to get the package but instead was sent to the custom house.

Ransoming the Package

"At the custom house the real stamping act work begun and for each parcel I had to put a pesos (44 cents) stamp. I required two of these, or 88 cents. With these duties the cost of the anti-glare device was just five times what it sells for in the U. S. A. In addition I had spent nearly a week getting the parcel post package through the post office and custom house.

"After all this trouble I asked what I had been paying for and the chief of the department advised me that the parcel post of the United States is a one-sided affair, and while they send any parcel away from the U. S. A. at regular rates yet in Argentina they charge duties and customs as they wish. The United States should get real parcel post service as far as Argentina is concerned. For reasons I cannot explain parcel post packages from Europe enter Argentina free. When asking why this is, the only answer you get is that if anything is wrong the U. S. A. is at fault. It is pretty hard to buy U. S. A. accessories here and pay exorbitant duties while European goods come in free. It is a subject which U. S. A. accessory manufacturers should consider.

"Now that U. S. A. cars are selling in good quantities through Argentina it is imperative to have accessories for them. Naturally parcel post is one of the simple ways of handling this work and it should be worth while to get parcel post service for Argentina on the same basis as that from England."

Troubles With Shipments

This is only one of the many difficulties the South American automobile dealer has to put up with in connection with shipments from the U. S. A. Recently a large accessory dealer from Cordoba, a city in the interior of Argentina, was required to make a night's trip by railroad from Cordoba to Buenos Aires because of custom difficulties in connection with U. S. A. shipments. The dealer makes a specialty of U. S. A accessories, but has constant troubles with shipments. On the occasion in question the New York shipper had not made his shipping documents correspond with packages sent. The shipping document showed five packages or crates but there were only four in the custom house. An examination disclosed the fact that the shipping department had combined two of the crates without making the necessary corrections on the document. This resulted in a cost of nearly $70 U. S. A. gold to the Cordoba dealer.

Recently a Buenos Aires dealer in hardware and automobile accessories cited another glaring example of the treatment Argentine merchants are being given at the hands of U. S. A. makers. The dealer here ordered $400 (U. S. A. gold) worth of certain hardware. It was necessary to pay cash with order in order to be assured of reasonably prompt delivery. This order was placed in August, 1915, practically a year ago. In September, 1916, the shipment had not arrived. It arrived a few weeks ago. The U. S. A. manufacturer had the use of the money for a whole year. During that time numerous excuses for delayed delivery had been made. When the order was placed in 1915 there was a great shortage of this kind of hardware in Buenos Aires and the dealer would have had a good ready market. Now conditions have changed. Other supplies have arrived and the market is lower. It is almost impossible in the face of such treatment to see any possibility of U. S. A. firms holding Argentine trade after the present war unless it is that European countries are not financially able to come back and give the market service which they gave before the opening of the war in July, 1914.

New York, Nov. 28—The freight car shortages has become so serious as a result of the big tieup of cars being used on tracks other than their own, that immediate steps have been taken by the railroads to relieve this condition. All of the railroads of the country have been notified to return to their home lines as soon as possible all cars not their own, especially those used for perishable freight. All shippers and receivers have been notified that freight left on cars for 10 days will be summarily removed by the railroads and the shipment stored at the shipper's or consignee's risk.

Freightage has become so heavy on the smaller railroad lines, that they have been forced to borrow cars from the larger lines, thus curtailing their use on larger lines where they are badly needed at the present time. For instance, one line running out of Detroit bought 9000 cars last year. Less than one-third of these are now in use on its tracks.

With the exception of Fords, which are shipped in parts to assembly plants, all automobiles are being shipped in special cars, either with end doors or very wide side doors. When these cars are diverted to other traffic, the rest of the box cars become useless. Some of the automobile factories have been taking long chances by shipping their products in flat cars over which they construted temporary tops and in coal cars covered with tarpaulins.

Car Makers Unable to Ship

Detroit, Nov. 25—More than $4,000,000 worth of automobiles are awaiting freight cars to carry them to their destinations. The shortage has become so severe that manufacturers are seeking storage space so that they can manufacture far enough ahead to care for future business.

Goodrich Accessory Assn. Changes Name

Philadelphia, Nov. 27—The Goodrich Accessory Association of Philadelphia, manufacturer of the Goodrich lock and switch for Fords, license brackets, truss rods, ignition assemblies, and brake shoes for Fords, has changed its name to the Goodrich-Lenhart Mfg. Co., with offices in the Widener Building as heretofore.

The officers of the company remain the same, Ivan Goodrich is acting president and manager of sales, and Mr. Lenhart will continue in active charge of the factory in Hamburg, Pa.

NEW YORK, Nov. 21—Yesterday and to-day the research division of the S. A. E. standards committee tried out their recommended standard form for economy and acceleration testing, using the Sheepshead Bay speedway for the trial. It was desired to ascertain if the committee's recommendations were entirely practical, which proved to be the case. Cars for the test were lent by the Marmon company and the Packard company and members of the New York staffs of these firms assisted the members of the committee.

For the acceleration tests records were made on rolls of paper, marks being made as the car reached successive distances equally spaced. In one system there were switches set on the track 100 ft. apart, these being set by a device attached to the front axle, and in this case the recording drum with the paper was stationary. In the other the track switches were replaced by a commutator attached to the front wheel of the car, which made contact once during each turn of the wheel, the recording drum being carried on the car.

In comparing the two methods it would appear that the stationary apparatus is more convenient for a series of tests on different cars, while that mounted in the car itself is a little more flexible for use on the one car. The record of the former is more compact and easier to use for plotting, because there are a smaller number of indications of distance, and these are in even figures. With the latter, acceleration runs are not limited in length, and can be made at any convenient place. There was some discussion as to the accuracy of measuring distance by the front wheel but it was found that two measurements, one at high speed and the other at low speed, checked accurately within the limits of personal error. The slight apparent difference was that the wheel made two more revolutions at high speed than at low speed over the same distance. There is still some question as to the accuracy of a chronometer carried on a car moving at high speed. A series of apparently perfect records was obtained by both methods, in a number of instances records being made by both devices on the same car during the same run.

Each of the cars was given a series of runs for fuel economy, one covering 4 miles at speeds of 6.9, 11.9, 21.6, 27.5, 40, 53.5, 63 m.p.h., and the other being given a similar series of runs at speeds of 9, 19.5, 29.5, 44, 57 and 63 m.p.h. As this was in no sense a regular test of the cars, they were run part of the time with tops down instead of up as called for in the tentative recommendation of the division. Also as the time devoted to the fuel-economy runs was limited, the lengths of different runs were cut down from the specific distance of 10 miles at each of the various speeds except the lowest, which is to be of sufficient length to consume at least 2 lb. of fuel, making complete circuits of the course.

The method used for measuring the fuel is to have two small tanks mounted on the windshield. One of the tanks is arranged for easy detachment so that it can be weighed before and after each run. Both are connected to the carbureter after the regular gasoline pipe is disconnected. The shut-off cocks from the two tanks are interconnected so that the same motion shuts one cock and opens the other.

The tank containing the unweighed fuel is used for manipulating the car and driving before each run at the same speed at which the run is to be made, in order to get the car to the temperature prevailing during the run. As the starting line is crossed the change is made from the unweighed tank to the weighed one, and vice versa at the finish line.

New Madison Four-Passenger Roadster

ANDERSON, IND., Nov. 27—The Madison Motors Corp. is placing on the market a new four-passenger roadster on its 120-in. chassis. It is equipped with a 3¼ by 5 in. Rutenbur engine, and lists at $1,150. The finish is mouse-gray, with red wheels and black fenders.

Remodel Aeroplane Factory

DETROIT, Nov. 25—The Williams Aeroplane factory at Fenton, Mich., has been remodeled and made ready for new machinery.

Ontario Registrations

WALKERVILLE, ONT., Nov. 24—The province of Ontario leads the other Canadian provinces with 36,300 registrations. Saskatchewan is next with 11,966; British Columbia, third with 9100. There are about 120,000 cars in the whole of Canada, of which 100,363 are Fords.

Toronto leads with 8815 cars as compared with 7367 in 1915. Montreal is second with 3917; Vancouver, third with 3688; and Winnipeg fourth with 3688.

254,000 Ohio 1917 Registrations

COLUMBUS, OHIO, Nov. 25—So far 254,000 registrations for 1917 for automobiles have been issued in Ohio. That number includes gasoline and electric car owners as well as dealers and manufacturers.

Banquet Dec. 15

NEW YORK, Nov. 28—A meeting of the truck standards division of the Society of Automobile Engineers was held in Detroit yesterday, for the consideration of military truck specifications. General progress in the consideration of the subject was made. H. D. Church of the Packard company presided, and General Manager Coker Clarkson attended.

At the next meeting of the Indiana Section, S. A. E., Dec. 15, the subject for consideration will be carbureters and manifolds.

The Cleveland Section S. A. E. at its meeting Dec. 15 will have a paper by J. B. Replogle on how car manufacturers can co-operate with manufacturers of electrical apparatus, such as starting, lighting and ignition. Mr. Replogle is research engineer of the Remy Electric Co.

The Mid-West Section will hold its December meeting on Friday the eighth at Chicago, when Prof. Roach of Armour Institute will outline a new method of test for gasoline engines.

At the meeting of the Metropolitan Section S. A. E. New York, Dec. 21, Elmer Sperry, inventor of the gyroscope and authority on aviation engineering, will speak on the military aspect of aviation possibilities in America.

The Detroit Section, S. A. E., has decided that its annual banquet to the automobile industry will be held at 7 o'clock on Friday evening, Dec. 15, at the Ponchartrain Hotel. This will be the second dinner of the kind by this section, the one a year ago marking the start of the movement.

Belgian Automobile Engineers in Detroit

DETROIT, Nov. 28—P. E. Kellecom and J. R. Perrier, engineers of the Fabrique National des Armes de Guerre of Belgium, are in this city investigating the automobile production. They state that the European countries plan to enter immediate quantity production at the end of the war.

Cadillac Builds New Sales Structure

DETROIT, Nov. 27—The Cadillac Motor Car Co. will erect a seven-story structure on the site of several temporary buildings, and will use it exclusively for retail sales and service. The building will contain 154,000 sq. ft. of floor space and will have a special feature of a reception room for the service department that will measure 65 by 116 ft., with a domed ceiling 29 ft. high.

Want Higher Fees for Trucks

Commissions Appointed by N. Y. and N. J. Seek Basis Covering Wear on Roads

NEW YORK, Nov. 27—Commissions have been appointed in this State and in New Jersey to determine an equitable basis for increasing the motor truck registration fees. This action is due to the depreciation of the roads in these States, a large measure of which, it is claimed, is caused by the increasing use of motor trucks. The work of the New York commission applies only to the State roads, and, since only about one-fifth of the trucks in the State are driven over these roads, the problem of arriving at a just determination as to how trucks shall pay in proportion to their use of these highways is very difficult. The task of the New Jersey commission is no easier, due to the practical impossibility of increasing the fees of the vehicles responsible for the wear on the roads without discriminatory taxation.

Of National Importance

Any action taken in New York and New Jersey in increasing registration fees for motor trucks will have a wide influence on the procedure in other States throughout the country, so the matter is of national importance.

The New York State Commission, composed of the State engineer, the commissioner of public works and the highway engineer held its first public hearing at Albany Nov. 21. This commission has not yet promulgated any new proposed schedule, so that the first hearing before it resulted in the giving of suggestion. Among the most important of these was the fact that roads should be classed as governmental or State institutions, benefiting alike those who use them as well as those maintaining plants in the area served or those who own real estate in the same territory.

It was pointed out that any law passed basing fees upon the extent of use and wear and tear of roads should include all forms of vehicles, including horse wagons, as well as automobiles and motor trucks. If motor trucks are taxed and not the other types, such a provision would be unconstitutional because of its discriminatory nature.

The impossibility of living up to the word of the New York State law which specifically provides that the new schedule of fees be based upon the extent of use and amount of wear and tear, was brought out by the fact that any such determination along scientific lines would require a tremendous amount of experimentation of various kinds of vehicles operating over various classes of roads at various times of the year.

It was pointed out that upon principle all vehicles should be charged a certain fee to cover registration for identification only and that any additional tax to help pay for the cost of construction and maintenance of the roads should be placed upon all vehicles.

The New Jersey State Commission, which is formed of the engineers of the various counties, acting under the supervision of the State Commissioner of Motor Vehicles is seeking to preserve the present roads until such time as new roads can be built to carry the vastly increased amount of traffic now passing through the State. This Commission, like the one in New York, has its powers limited to the taxation of the motor truck alone and it cannot decide upon any similar tax for horse vehicles.

Geronimo Plant for Enid, Okla.

ENID, OKLA., Nov. 25—The Geronimo Motor Car Co. has been organized to manufacture automobiles in this city in a three-story plant. It will produce a six-cylinder car with a Continental motor. The directorate consists of mostly local bankers, and the capital is $500,000. Shands & Funnel are the fiscal agents for the company.

W. C. Allen is president, G. E. Darland is secretary and treasurer and Walter Krouse is vice-president. F. B. Buzzard is a director.

Overland Opens N. Y. Salesroom

NEW YORK, Nov. 28—The Willys-Overland Co. to-day opened its new retail sales and display rooms on Broadway and Fiftieth Street. This building is three stories and has a frontage on Broadway of 100 ft.

Local Shows

NEW ORLEANS, Nov. 27—The success of the automobile displays at the National Farm and Live Stock Show here has caused much talk among dealers for a concerted effort toward making this exhibition the occasion of an automobile show. The eight dealers who have displays there are telling of sales made and of many prospects obtained. The reason for the limited number of displays was that the managers of the show proposed a tent exhibit, but later consented to place the automobiles in the Manufacturers' Hall. The dealers hope by beginning in time to arrange for suitable quarters next year.

Worcester Show a Success

WORCESTER, MASS., Nov. 25—The second annual show of the Worcester Automobile Dealers Assn. ended here to-night and it proved to be a bigger success than the men anticipated.

U. S. Wheel Corp. Is Organized

New Concern Will Manufacture Baker Pressed Steel Wheel—Production Starts Jan. 1

CHICAGO, Nov. 28—The U. S. Wheel Corp. is a new organization formed for the purpose of manufacturing the Baker pressed steel wheel for automobiles, motor trucks, tractors, etc. This concern is an outcome of the Baker Wheel & Rim Co., of this city, a $5,000 corporation organized for the development of the Baker wheel. The U. S. Wheel Corp., which has absorbed the Baker Wheel & Rim Co., will have a large capitalization. Factory location has not yet been decided upon and at the start production will be by having the most of the work done by pressed steel specialists. Production will be started soon after Jan. 1.

Spokes Under Tension

The Baker pressed steel wheel is a flat-spoke type with spokes arranged bicycle-wheel fashion and held under tension. The wheel is stamped from an original circular piece of steel. It is first converted into a plate-shaped stamping resembling a large brake drum which would be the diameter of the wheel. By a further stamping process the spokes are formed. Alternate spokes attach to opposite ends of the hubs, giving two circles of spokes. The wheel is of approximately the same weight as an artillery wood wheel for motor cars. At present two of the large automobile makers are testing the wheel and others are arranging to test it.

The U. S. Wheel Corp. will have for its president, Chas. G. Hawley, a Chicago man representing financial interests. Jos. A. Anglada, consulting engineer of New York City, will be vice-president. For 3 years Mr. Anglada was chairman of the Metropolitan Section S. A. E. Erle K. Baker, inventor of the wheel, will be secretary. Mr. Baker is best known as the inventor of the Baker split rim, which is now used exclusively by the General Motors. Mr. Anglada will move to Chicago to devote his entire work to the organization.

Reo Makes Additions to Factory

LANSING, MICH., Nov. 27—The Reo Motor Car Co. is adding two large buildings to its plant. The larger will be 76 by 528, and will be used as a machine shop, and the smaller will be 95 by 224 and will be occupied for heat-treating purposes. The company is also completing a garage and a clubhouse for its employees.

Studebaker Holds Conference

225 Officials Attend South Bend and Detroit Meeting —Interesting Addresses

SOUTH BEND, IND., Nov. 27—More than 225 officials, branch managers, blockmen and dealers connected with the Studebaker sales department, were entertained Wednesday at the annual conference. The program which started in South Bend was concluded Thursday and Friday at the Detroit factory, followed by private conferences with branch managers and blockmen on Saturday. The yearly conference is a sort of debutante party for the new model car, which is brought out about this time.

Four Addresses

Four addresses were delivered at the meeting Wednesday morning in the administration building. The welcome was delivered by F. S. Fish, chairman of the board, who was followed by President A. R. Erskine, giving a resume of the year's work. J. M. Studebaker followed Mr. Erskine, with a talk on "Sixty-four Years of Business Administration." L. J. Ollier spoke at length on the sales policy for 1917. He stated that the corporation did a larger business last year than ever before and that they expected to exceed all previous sales records in 1917.

Speeches at Detroit

Addresses at Detroit were made by R. T. Hodgkins, general sales manager, C. C. Hanch, treasurer, H. T. Myers, commercial car manager and G. L. Willman, assistant sales manager and advertising manager.

L. Markle, the Chicago Studebaker representative, to-day, told of the Studebaker systematic service plan of caring for the car after it is sold, C. N. Weaver, of San Francisco discussed "Exclusive Representation," and E. R. Benson, Portland, Me. presented the dealer's view of Studebaker methods.

The convention closed to-day, with a banquet at the Detroit Athletic Club. L. J. Ollier, vice-president, presided as toast-master.

Special Train for Overland Convention

ST. LOUIS, Nov. 27.—T. L. Hausmann of the Overland Automobile Co. of St. Louis has completed arrangements for a special train to leave here the night of Dec. 10 to take 150 persons to Toledo for the annual Overland convention. The train will be of fifteen sleepers and the delegation will include the local sales force and nearby dealers.

Electric Auto-Lite Service Meeting

TOLEDO, OHIO, Nov. 27—The Electric Auto-Lite Co., this city, will hold a meeting for its service representatives at the factory Dec. 4 and 5, at which it is expected that more than seventy-five will be in attendance.

Bennett Perfecting Distribution Plan

DETROIT, Nov. 24—O. G. Bennett, who resigned from the presidency of the General Export Co., is developing a new automobile distribution plan.

Moon Ships to Porto Rico

ST. LOUIS, MO., Nov. 27—The Moon Motor Car Co. has made a shipment of twenty-five cars to Santiago A. Panzardi of San Juan, Porto Rico, which has taken fifty-five cars from this company since May. The company has agencies in Cuba and formerly sold French and other European cars.

Decker Top Increases Capital

DETROIT, Nov. 24—The Decker Auto Top Co. has increased its capital from $15,000 to $50,000.

Gary Truck Capital Doubled

SOUTH BEND, IND., Nov. 27—The Gary Motor Truck Co., Gary, Ind., has increased its capital stock from $25,000 to $50,000.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge
Aluminum, lb.	.65	.65	.65	.65	.65	...
Antimony, lb.	.14	.14	.14	.14	.14	...
Beams & Channels, 100 lb.	2.97	3.17	3.17	3.17	3.17	+ .20
Bessemer Steel, ton	$52.50	$52.50	$52.50	$52.50	$52.50	...
Copper, Elec., lb.	.33	.35	.35	.35	.35	+ .02
Copper, Lake, lb.	.33	.35	.35	.35	.35	+ .02
Cottonseed Oil, bbl.	12.85	12.75	12.65	12.75	12.70	— .15
Fish Oil, Menhaden, Brown, gal.	.68	.68	.68	.68	.68	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb.	7.15	7.20	7.30	7.30	7.30	+ .15
Linseed Oil, gal.	.96	.96	.96	.96	.96	...
Open-Hearth Steel, ton	$52.50	$52.50	$52.50	$52.50	$52.50	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.80	.80	.80	.80	.80	...
Rubber, Ceylon, First Latex, lb.	.69	.71½	.70	.70	.70	+ .01
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	45.30	45.75	45.50	45.50	45.50	+ .20
Tire Scrap, lb.	.06¼	.06¼	.06¼	.06¼	.06¼	...

Materials Market Steady

Copper, Steel and Lead Slightly Higher—Rubber and Oils Little Changed

NEW YORK, Nov. 27—Prices on automobile materials last week were exceedingly steady, despite the scarcity of these products and the large demand for them. Copper, which has been uppermost in the skyward activities of the metals, has risen 2 cents more a pound to 35 cents. Beams and channels, after quite a steady period, have taken a turn upward, rising to $3.17 per 100 lb., a net gain of 20 cents for the week. Lead prices, always fluctuating, reached $7.30 per 100 lb. on Thursday, holding at that price through to Saturday.

Rubber and the oils have been unusually steady, with few price changes. Shipments of rubber have been coming in regularly from Ceylon. Para rubber seems to have steadied down to normal prices after a period of unsteadiness on account of conditions on the Amazon River.

Standard Parts Stock Issue

CLEVELAND, OHIO, Nov. 25—The Maynard H. Murch Co., investment broker,, is offering a new issue of 7 per cent cumulative tax free preferred stock of the Standard Parts Co., the consolidation of the Perfection Spring Co. and the Standard Welding Co. Par is $100 a share and the dividend periods are March, June, September and December. Of the authorized capital of $10,000,000 preferred, $5,000,000 is to be issued and of the authorized issue of $25,000,000 common only $8,000,000 is to be issued at this time.

White Wants Tax Reduction

CLEVELAND, Nov. 24—County Auditor Zangerle added $5,000,000 to the White company's statement, claiming this to be good will. The company asks for a reduction of valuation amounting to $13,071,000, which the auditor has refused to make.

Metz Makes Welfare Improvements

WALTHAM, MASS., Nov. 24—The Metz Co., this city, has formulated plans for the social benefit of its employees. A clubhouse, athletic field and the freedom to a tract of 147 acres of land are included under the new welfare policy. There is also in contemplation a gymnasium, a separate baseball field, and ½-mile track, which will probably be built in the spring. An adjoining building to the executive and sales force offices, is now being converted into an engineers' club.

Production at the plant has been increased 40 per cent, and now the capacity is more than 100 cars a day.

Bonus for Westinghouse Employees

PITTSBURGH, PA., Nov. 24—Employees of the Westinghouse Electric & Mfg. Co., this city, have been granted an extension of their present bonus system which is to include salaried and office employees on hourly rates, by which they will receive a bonus of 8 per cent of their salary each month, providing their total excusable time absent and late during the month does not exceed 6 hr. incurred on not over three occasions.

An additional 4 per cent will be given each month to employees who have not lost any time from work during the month through absence or tardiness.

Automobile Lock Co. Incorporates

GRAND RAPIDS, MICH., Nov. 24—The S. & S. Auto Lock Co. has been incorporated for $20,000. Incorporators are E. W. Slausson, W. B. Brown and A. M. Freeland.

Disbrow Motors Co. Organized

CLEVELAND, Nov. 24—The Disbrow Motors Co. has been organized with a capitalization of $25,000. Incorporators are Louis Disbrow, W. D. Callinan, M. Becker, M. L. Fisher and A. B. Crowell.

Automobile Issues Fluctuate

Lower Than Last Week—General Motors and Chevrolet Lead Decline

NEW YORK CITY, Nov. 27—Automobile and accessory issues on Saturday closed lower though stronger than on the previous Saturday. There has been a lot of covering in the motor shares during the last few days. Their position had grown strong during the early part of the week as a result of too much enthusiasm on the short side. Motor issues, it seems, are usually in fair demand when other industrials are depressed, and vice versa.

Chalmers and General Motors were the features last week. Chalmers rose 4 points on its common and General Motors dropped 90 points after a similar gain in the previous week. Chalmers held strong despite the publicity given the stock on account of the short selling of its underwriting syndicate. Threats have been made that the handling of the stock would be brought to the attention of the governors of the stock exchange, but this did not affect the issue one way or the other.

The automobile and accessory issues have been on a down market for some time, but it is expected that as soon as the short sellers have their run, prices in general will rise to and above their old marks. Last week Chevrolet dropped 4 points to 172; Peerless dropped 2 points. A few gains were made, however, led by Chalmers, Chandler, Miller, Packard, Regal and Overland. Chalmers rose 4 points on its common; Chandler rose 4 points; Miller Rubber rose 5 points; Packard preferred rose 7 points; Regal, 5 points and Overland 5-8 points on its common and 3⅛ on its preferred.

Barley Increases Wages

STREATOR, ILL., Nov. 27—The Barley Mfg. Co., Streator, Ill., maker of the Roamer and the Halladay, announced an increase in wages, or rather the operation of the plant on an 8-hr. basis with 10-hr. pay. In addition, there will be a bonus for the senior employees, etc.

Dividends Declared

Stutz Motor Car Co. of America, $1.25-100 per share, payable Jan. 2, 1917, to stock of Dec. 15. Mitchell Motors Co., $1.50 per share to stock of record of Nov. 10, payable Nov. 24.

Morgan & Wright, coupon due Dec. 1 upon 5 per cent gold debentures is payable upon presentation at the Industrial Trust Co., Providence, R. I., or the Chase National Bank, New York.

Texas Co., $2.50 per share on outstanding capital stock, payable Dec. 31 to stock of record Nov. 29.

C. M. Hall Lamp Co., quarterly of 2 per cent.

Packard Motor Car Co., quarterly of 1¾ per cent, payable Dec. 15.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	70	72	—3½
J. I. Case T. M. Co. pfd	87	88	—1
Chalmers Motor Co. com	134	150	+4
Chalmers Motor Co. pfd	111	114	+1
*Chandler Motor Car Co.	110	112	+4
Chevrolet Motor Co.	172	180	—4
Fisher Body Corp.	38	42	..
Fisk Rubber Co. com	80	90	..
Fisk Rubber Co. 1st pfd	100	110	—9
Fisk Rubber Co. 2d pfd	90	100	—5
Firestone Tire & Rubber Co (new com.)	168	171	..
Firestone Tire & Rubber Co. pfd	106	108	..
*General Motors Co. com	510	875	—90
*General Motors Co. pfd	120	123	..
*B. F. Goodrich Co. com	70½	71	+ ¼
*B. F. Goodrich Co. pfd	113½	114	..
Goodyear Tire & Rubber Co. com	294	297	—1
Goodyear Tire & Rubber Co. pfd	108½	109½	— ½
Grant Motor Car Corp.	8	9½	+1
Hupp Motor Car Corp. com	4	5	— ½
Hupp Motor Car Corp. pfd	80	95	—5
International Motor Co. com	5	8	..
International Motor Co. pfd	23	..	+1
*Kelly-Springfield Tire Co. com	76¾	77¼	— ¾
*Kelly-Springfield Tire Co. 1st pfd	96	99½	..
Keystone Tire & Rubber Co. com	15½	16	..
*Lee Rubber & Tire Corp.	38½	39	—1¼
*Maxwell Motor Co. com	74	74½	—2
*Maxwell Motor Co. 1st pfd	81½	82	+ ½
*Maxwell Motor Co. 2d pfd	49½	50¼	— ½
Miller Rubber Co. com	255	260	+5
Miller Rubber Co. pfd	107	108	+1
Mitchell Motors Co.	59	60½	..
Packard Motor Car Co. com	173	176	..
Packard Motor Car Co. pfd	101	103	+7
National Auto Corp.	..	..	..
Paige-Detroit Motor Car Co.	38	38¾	— ½
Peerless Truck & Motor Corp.	21	23	—2
Portage Rubber Co.	165	170	..
Regal Motor Car Co. pfd	25	35	+5
Reo Motor Car Co.	45½	46½	— ½
A. O. Smith Corp. com	78	79	..
A. O. Smith Corp. pfd	96¾	97	+ ¾
Saxon Motor Car Corp.	78	80	— ¾
Spicer Mfg. Co.	47¾	47⅞	— ⅜
Springfield Body Corp. com	90	95	..
Springfield Body Corp. pfd	120	130	..
Smith Motor Truck Co.	6⅛	6⅜	— ⅛
Standard Motor Construction Co.	7	7½	..
Stewart Warner Speed. Corp. com	106	108	—1
Stewart Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	124	124¾	— ½
*Studebaker Corp. pfd	109¼	110	..
Stutz Motor	65	65½	..
Swinehart Tire & Rubber Co.	85	89	—1
United Motors Corp.	61½	62	— ¼
*U. S. Rubber Co. com	65½	66¼	+3½
*U. S. Rubber Co. pfd	112½	113	— ⅜
White Motor Co.	54	54½	— ⅜
*Willys-Overland Co. com	38½	38¾	+ ⅜
*Willys-Overland Co. pfd	98¼	98½	+3⅛

*At close Nov. 25, 1916. Listed New York Stock Exchange. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	45	48	+ ½
Chalmers Motor Co. com	140	150	+10
Chalmers Motor Co. pfd	112	..	+2
Continental Motor Co. com	41½	42½	+1½
Continental Motor Co. pfd	9¾	10¼	+ ¼
Ford Motor Co. of Canada	293	305	+3
General Motors Co. com	..	825	..
General Motors Co. pfd	118	122	—5
Maxwell Motor Co. com	74	77	— ½
Maxwell Motor Co. 1st pfd	80	83	— ½
Maxwell Motor Co. 2nd pfd	48	51	—1
Packard Motor Car Co. com	172	176	..
Packard Motor Car Co. pfd	104	..	+4
Paige-Detroit Motor Car Co.	38¼	..	— ¼
W. J. Prudden Co.	49	50	..
Reo Motor Car Co.	45	45½	— ½
Studebaker Corp. com	124½	127	— ½
Studebaker Corp. pfd	107	..	—1
C. M. Hall Lamp Co.	29½	..	..

INACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd	25	..	..

$14,000,000 Dealer Merger

Aaron De Roy Co. Combines with Studebaker Sales Co. of Ohio—Contract Enlarged

DETROIT, Nov. 27—The Aaron De Roy Motor Car Co., distributer of Studebaker cars for Pittsburgh and western Pennsylvania, has merged with the Studebaker Sales Co. of Ohio. The Studebaker Sales Co. was incorporated in September and combined the Blevins Auto Sales Co. of Toledo and the A. R. Davis Motor Co. of Cleveland, so that the new merger includes three of the largest Studebaker distributers. The original contract between the Studebaker Corp. and the Studebaker Sales Co. called for $12,000,000 worth of cars. With the new merger the contract has been changed to $14,000,000, and is the largest single contract made in the history of the industry.

Baker Takes Atlantic and Horner

BOSTON, Nov. 25—Day Baker, one of the pioneers of the electric field in New England, who resigned recently as an executive of the General Vehicle Co. at New York, has taken on the Atlantic electric and the Horner gasoline trucks for New England.

Leavitt Will Handle Columbia

DETROIT, Nov. 25—J. W. Leavitt will handle the Columbia car for the Pacific coast and is making his preliminary plans for a large campaign.

Westinghouse Makes A.B.C. Starter Contract

DETROIT, Nov. 25—The Westinghouse Electric Co. has closed a contract for $250,000 worth of electrical supplies with the A.B.C. Starter Co.

Auto Specialties Gets Overland Contract

DETROIT, Nov. 24—The Willys-Overland Co. has contracted with the Auto Specialties Co., St. Joseph, Mich., for 300,000 Bair automobile top holders.

Kline in New York

NEW YORK, Nov. 27—The Kline Car is now handled in this city by the W. S. Roberts Motor Corp., 1838 Broadway, at Sixtieth Street.

Hassler Motor Co. Formed

INDIANAPOLIS, Nov. 27—The Hassler Motor Co., this city, has been incorporated with a capitalization of $200,000, the incorporation papers stating that the company will manufacture automobiles. R. H. Hassler, head of Robert H. Hassler, Inc., manufacturer of automobile parts, who heads the new company, declined to make any announcement of the company's plans, stating that the plans would be announced in the near future. The incorporators, in addition to Mr. Hassler, are E. D. Fouts and D. G. Ong.

Gillam Increases Capital to $800,000

DETROIT, Nov. 28—The Gillam Mfg. Co. has voted to increase its capital stock from $350,000 to $800,000. An issue of $225,000 7 per cent cumulative preferred stock was authorized and has already been subscribed for by present stockholders and others. The company will erect a building for malleable iron manufacture and one for semi-steel work to meet the increasing demand for its products.

Wright Adapter Now Western

SEATTLE, WASH., Nov. 27—An agreement has been reached by the Wright Truck Attachment Co. and the Truck Attachment Co., both manufacturing Ford truck adapters under the name Wright, under which the former concern becomes the Western Truck Attachment Co. and its product the Western attachment.

Acme Truck Maker to Add

CADILLAC, MICH., Nov. 27—The Cadillac Auto Truck Co., this city, maker of the Acme 1 and 2 ton trucks, will soon add to its factory a new concrete, steel and brick building 96 by 176 ft. The new 3½-ton model is well under way.

Universal to Organize Subsidiaries

DETROIT, Nov. 27—The Universal Valveless Four Cycle Motor Co. will move from Grand Rapids to Muskegon, establishing a plant there, with C. E. Johnson president, and will organize subsidiary companies to manufacture its motor. The parent company will have a capitalization of $250,000.

New Era Increases Factory

DETROIT, Nov. 24—The New Era Spring & Specialty Co. has increased its productive facilities at Grand Rapids by the purchase of the Ruskin Biscuit plant, which is to be remodeled immediately. The company will maintain its main salesrooms at Detroit.

Trucks Carry U. S. Munitions

EL PASO, TEX., Nov. 27—Motor trucks transported the trainload of shrapnel and cannon shells recently received here to Colonia Dublan, the advanced base. There were twenty-seven box cars of ammunition, containing 67,500 shells, packed four to a case.

Kemco Starter Under Hood

Type of Mounting on Ford Crankshaft in Front of Radiator Abandoned

NEW YORK, Nov. 28—The Kemco Electric Mfg. Co., Cleveland, has changed its starting motor for Ford cars so that it will be located under the hood instead of on the crankshaft in front of the radiator, as heretofore. The construction of the motor has undergone no decisive change, although it is somewhat smaller and lighter. It will be installed at the right of the engine and bolted firmly to a casting which takes the place of the front plate on the Ford engine, this casting also being employed as a bracket for the generator. The drive will be by sprockets and roller chain direct to the crankshaft. The fan-type generator will remain unchanged with the exception of its connection with the starting motor, the drive being direct to the crankshaft instead of through the jackshaft assembly.

Chevrolet 6000 Cars Behind Orders

DETROIT, Nov. 27—The Chevrolet Motor Co. will close November 6000 cars behind on deliveries on the month's business alone. The scheduled output for December is 10,000 cars. The company reports an export business that will probably amount to 10,000 cars for 1916.

Taylor Timken Advertising Manager

DETROIT, Nov. 28—W. H. Taylor has been appointed advertising manager of the Timken Roller Bearing Co., this city. Mr. Taylor was formerly with the Campbell Ewald Co. advertising agency in this city.

Chain of Disco Branches

DETROIT, Nov. 28—The Disco Starter Co. shortly will establish a chain of branches in the larger cities by way of facilitating the administration of service to owners. The first branches will be located in New York and Chicago.

New Champion Delivery Chassis

CHICAGO, Nov. 27—To manufacture ½- and ¾-ton delivery chassis the Champion Motors Co. has been formed by Cleveland interests in Fulton, Ill. The vehicles will have electric starting and lighting, bumpers, side curtains and other detail refinements. They will sell for from $750 to $775.

The plans of the company were first made public last Saturday, when ten of the new chassis were paraded down the main streets of Fulton to arouse public enthusiasm.

W. L. Widlar, N. R. Wildman and William Greif head the concern, which has a capital of $5,000,000. Mr. Widlar is interested in several accessory, lumber, real estate and steamship companies, and is president of the Champion company. Mr. Wildman, vice-president, is a financier of large interests, and Mr. Greif, secretary and treasurer, is heavily interested in a number of Cleveland manufacturing concerns. H. D. W. Mackaye is vice-president in charge of production and designer of the chassis. He has been employed by the Mora, Jenkins, Croxton-Keeton, Metzger, King and Keeton companies.

N. A. C. C.'s New Dealers' Arrangement for National Shows

NEW YORK, Nov. 27—The dealer arrangements for the national shows in New York and Chicago have been considerably simplified. Manufacturers will supply lists of dealers, and these lists will be checked and so blended that the name of a dealer cannot appear more than once. This means that if a dealer handles several lines of cars his name will appear but once instead of several times, as in the past. To each of these dealers will be sent three single admissions for his personal use. Dealers in important cities will receive three additional tickets, also intended for their personal use. In addition to these tickets, which will be sent direct to the dealers, each exhibiting member of the N. A. C. C. will receive a limited number of blank tickets to be distributed by the dealer to his representatives.

Three More Accessory Exhibitors

NEW YORK, Nov. 28—The Motor and Accessory Manufacturers have allotted space to three more accessory manufacturers for the New York and Chicago national automobile shows. This makes the total 343. They are: The Syracuse Malleable Iron Works, Syracuse, N. Y., maker of axles and castings; the Universal Motor Products Co., Indianapolis, winter tops for Fords, at both shows, and the Ericsson Mfg. Co., Buffalo, maker of the Berling magneto, at New York only.

New Era Buys Accelerator

DETROIT, Nov. 27—The New Era Spring & Specialty Co. has purchased the Ford foot accelerator formerly manufactured by H. E. Petrie of Battle Creek. About $8,000 was involved in the transaction.

Specialty Mfg. Co. Organized

DETROIT, Nov. 24—The Specialty Mfg. Co. has been organized at Minerva, Ohio, to make automobile accessories.

Drivers To Build Racing Cars

De Palma, Rickenbacher and Chevrolet Will Manufacture Machines in Detroit

DETROIT, Nov. 27—De Palma, Rickenbacher and Chevrolet are going to manufacture racing cars for their own use in the 1917 speedway campaign. Rickenbacher, who is entered in Los Angeles for the 150-mile Ascot race, will come to Detroit to build a team of racing cars to be owned hy W. Weightman, III, of Kenova, W. Va. Chevrolet will work over the three Frontenac cars built jointly by himself and Joseph Boyer, Jr., this year. De Palma will devote himself to the De Palma Mfg. Co., which is to build special speedsters for those who want cars of that type.

Two Killed at Uniontown Speedway Practice

UNIONTOWN, PA., Nov. 27—C. M. Heist of Sharpsburg, Pa., and F. E. Bush of Pittsburgh, his mechanician, were killed to-day while traveling 60 m.p.h. on the local automobile speedway in preparation for qualification tests for the race on Thanksgiving Day. The front axle of the car broke.

Swiss Magneto Moves to Monroe

MONROE, MICH., Nov. 25—The Swiss Magneto Co., manufacturer of Swiss high-tension magnetos, has moved from Chicago to this city, having bought out the Elkhart Mfg. Co., and now occupies its factory. The new facilities will enable the production of Swiss magnetos to be considerably increased. No change in personnel will be made. The manufacture of Elkhart magnetos, which were the product of the Elkhart company, will be discontinued, it is understood.

Issue Gasoline Cards in France

PARIS, FRANCE, Nov. 23—Gasoline tickets and a ban on the use of private automobiles, it is stated, is part of a scheme in this country, for regulating the consumption of food and other supplies. If necessary, the government will forbid the running of any automobiles except public or semi-public machines.

104 Cars Burned in St. Louis

ST. LOUIS, Nov. 28—One hundred and four Overland cars were destroyed here yesterday in a fire in a wing of the warehouse of the Cedar Street Warehouse and Storage House. The machines were the property of the Willys-Overland Co. and were insured through the Toledo office. All were intended for Southwestern distribution. The local distributer says that the loss will not cause immediate inconvenience. Eight hundred additional cars of various makes in the main storage house were saved by closing of fire doors.

White Detroit Battery Sales Mgr.

DETROIT, Nov. 28—C. E. White has become sales manager of the Detroit Battery Co., this city. He was formerly connected with the General Electric Co.

King Trailer Co. Formed

ANN ARBOR, MICH., Nov. 28—The King Trailer Co., this city, has been organized to make trailers and has purchased outright the Ann Arbor Buggy Co. L. C. Long is vice-president and city sales manager of the Chicago branch of the Federal Motor Truck Co. He was formerly New England sales manager for this company.

Victor Motor in Jenkintown

WILMINGTON, DEL., Nov. 27—The Victor Motor Co., which recently purchased land at Claymont, Del., for a plant, has decided to locate at Jenkintown, Pa.

Manly Truck in New Plant

CHICAGO, Nov. 27—A new factory in Waukegan, Ill., a short distance north of here along the lake shore, has been secured by the Manly Motor Truck Co., which recently put the Manly truck on the market. Tht new plant will be occupied about Dec. 1.

Marvel Accessories Capital Increased

CLEVELAND, Nov. 27—The Marvel Accessories Mfg. Co. has increased its capitalization to $100,000, and a new factory building, which will greatly increase output, is now under construction. When completed more than 45,000 sq. ft. of floorspace will be available.

Logan Leaves Logan-Fischer Co.

CLEVELAND, Nov. 24—C. M. Logan, president of the Logan-Fischer Motor Co., Chalmers distributors, is severing his connection with that firm.

Hupmobile Tour Reaches Santa Fé

DETROIT, Nov. 27—The Hupmobile capital-to-capital party reached Santa Fé, the thirty-fourth capital in its journey, on Nov. 23. The car is now on its way to Phoenix, Ariz.

Stern-wear Tubes on Market Dec. 1

ST. LOUIS, Nov. 27—The Efficiency Oil Corp., of this city, announces that Stern-wear inner tubes, guaranteed to wear 20,000 miles, will be placed on the market from the new factory here Dec. 1.

The Automobile

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Bed Rock

THE way in which automobile engineers this year have shown an inclination to get to the real bottom of subjects is very encouraging. There are many things in connection with automobile engineering that have been haphazard and rule of thumb, and they are mostly things that have been good enough in the past but are not good enough now, other parts of the chassis being improved so greatly. Such an example is the paper on retardation printed on another page, for it deals with primary forces and touches not at all on mechanical detail. Another constant subject of discussion during the year has been crankshaft balance, mainly a theoretical subject, the theory being forced upon us by the obvious imperfection of older designs.

There are many other things; lubrication is one, carburetion another and spring action a third, which may be mentioned as matters which require much more scientific treatment, and it would be easy to extend the list. The great thing, however, is not so much what has been done and is doing now, but the spirit of the thing. These discussions are lifting automobile engineering up to a higher plane; they mean that the automobile engineer of the future will need as good a scientific training as any other.

In its infancy the automobile industry was looked down upon by other branches of engineering because it had no theoretical basis; and in very truth it was once all a cut and try proposition. This is no longer so, and the cut and try methods of design and manufacture are dying, surely if not yet, very rapidly.

The automobile has really created a new section of engineering much broader than the road vehicle field. It has created the engineering of light structures, the engineering of weight saving. From the motor car chassis the aeroplane has grown, the high-speed boat has come into being and even railway engineering has felt the influence. This influence is but at its beginning. In the future we shall see much more machinery economical in use because light in weight, and all of it should go to the credit of automobile engineering. Let the good work go on.

Generator Reliability

THE only attention now needed by the electrical equipment of an automobile is the regular examination of the battery and occasional oiling of the generator and motor bearings. Adjustments of any kind are hardly ever provided by generator manufacturers, and they all state with emphasis that the less the owner knows of the existence of the commutator and brushes the better.

A generator and a starting motor should have an expert examination every 20,000 miles or so, or if they give trouble, but nearly every trouble that can occur happens outside the generator, which is about the most reliable part of the whole equipment.

Manufacturers list their troubles with generators as due to three things, over lubrication, under lubrication and "tinkering." Other troubles are all traceable to some accidental fault in manufacture and are correspondingly extremely rare. The reason for this is that the modern electric generator is extremely simple. It is far simpler than a magneto, for example. It did not take the public long to realize that any ignition trouble within a magneto was so rare that it need hardly be considered, and they would tackle spark plugs and wiring many times before commencing to investigate the internals of the magneto. Slowly, the same thing is becoming true of the electrical equipment; the generator is being suspected last of all.

Needs Little Attention

Like a magneto a generator is designed to run without attention, and there is no attention that can be given it which will help it to run properly beyond frequent, gentle lubrication. Its brushes require attention far less often than even the breaker points of a magneto, and when they do need touching it is usually a case of renewal rather than of adjustment. Never touch a generator until every detail of the battery and the wiring has been tested, not once, but several times, and thoroughly at that. This will be found the best policy at all times.

Commutator sanding and the fitting of new brushes are jobs that have to be done at rare intervals and they are not difficult, but they should never be attempted by anyone who has not been shown how by some man with experience in this work, otherwise the last state of the commutator may easily be much worse than the first.

Electric Systems Simpler

Better Manufacturing Feature of Starting and Lighting Equipment Progress in Year—Fewer Types Electrically and Mechanically — Two-Unit Gaining Steadily — More Generators with Ignition Combined—General Reduction in Weight

By A. Ludlow Clayden

THERE has been no really large change in the design of lighting, starting and ignition apparatus during the year of 1916. Every trend seen last year is seen again at present. The starting motor itself is almost eliminated from this discussion because it is so extremely simple that changes in its electrical makeup are unthinkable. The generator is becoming a better manufacturing proposition as the different big producers tool up for more and more each, of a decreasing number of models, for the innumerable patterns and designs each "special" in some way that the leaders of the industry were being forced to make two years ago, have been cut down and down again till unreasonable modifications are a minimum. The time is not far off when the generator business will be as standardized as carbureter manufacture. This is the case already in some plants, where the owners have had the courage to say to the automobile industry, "Gentlemen, here are our models of generator, we would like to have you choose one, but if none will suit you then please take your business to some other plant." Other plants not quite so courageous have gone a part of the way and persuaded some of their customers to give up needless petty individualities.

Concentration on Types

There is another thing, too, that has had an effect in improving the factory conditions, and this is that the electrical firms have been able to pick the types on which to concentrate. Some of the largest makers very wisely have been making machines of several different electrical systems. These they have sold in thousands and they have their records in service. In this way the most reliable out of two or three systems is quickly discovered, and a firm can concentrate on one system without any fear that they may not have made the best choice. The mere matter of size of generator had to be settled by time and experience, and we can see now that many machines being made two years ago were larger and heavier than they needed to have been. We have arrived at the light-weight generator by a series of successive easy stage reductions in dimensions. The substitution of press work and stamped parts for castings and forgings has enabled pounds of weight to be saved, but it has taken time to obtain and install the necessary presses, so here again a tendency observed last year is seen intensified at the present time.

Two-Unit Systems Almost Universal

It has become an accepted fact now that there are limits of rotative speed beyond which it is uneconomical to drive an armature, so this practically confines the single unit dynamotor with a constant gear connection with the crankshaft, to fairly slow speed engines. In cases where the engine runs upward of 2000 r.p.m. it is rare to find anything except two unit systems, excepting those few single units which have one connection to the crankshaft while being driven and another of lower ratio when they are operating as the starting motor.

For starting motor drives the Bendix pinion is still the almost universal equipment and it is unlikely that this eminently efficient and simple device will be displaced for a long time to come. Magnetic shifts are used on a few cars and mechanical shifts have not disappeared altogether, but there are very few of these remaining.

A matter which is still very much in the air is that of the attachment of the generator and the starting motor to the crankcase. At first almost all generators were designed to fit on a platform after the fashion of the magneto. Next, came round body generators which were clipped in cradles cast on the side of the crankcase and, finally, we now have the flange type of generator or motor, which has a large flange with three or four bolt holes on one end of the frame, attaching to a machined surface on the back of the crankcase front end, in the case of the generator, and to a facing on the crankcase rear arm in the case of the motor.

This flange mounting is every bit as secure as the platform or cradle mountings, especially with the present-day low weight of electrical units, and it is cheaper for the automobile manufacturer, because on a crankcase there are already several surfaces which have to be machined into planes at right angles to the axis of the crankshaft and it is little trouble to machine the necessary extra two faces for the generator and motor. The armatures of these two machines must be parallel to the crankshaft, and with a platform mounting some precautions in fitting have to be taken to insure the parallelism, thereby making the crankcase machining a little more expensive.

Flange Mounting Not Always Possible

A trouble, which is retarding the adoption of flange mountings more generally, is that it is not always possible to adapt this style to existing engines without alterations in the design of the crankcase. A committee of the Society of Automobile Engineers is investigating the situation, and has been doing so far nearly a year, and it has discovered a strong tendency amongst engine builders to make their new models suitable for flange mountings. This being so the S. A. E. expects that it will be able to standardize three flanges of different sizes, and that these standard ends for generators and motors will come steadily into use; though it may take some years for this to happen in cases where engine design has first to be changed.

One big advantage of the flange mounting is that it permits adjustment of the centers in the front end. If the flange has one round hole and two slotted holes it can be swung a little on one of the bolts, so allowing adjustment of the degree of mesh of the front end gears, or even effecting adjustment of the chain where a chain drive is employed for the generator. The starting motor does not need this adjustment, and may therefore have a standard flange somewhat different from that for the generator. The trend toward the use of the flange has begun and one of the largest suppliers is putting on all possible pressure to have it adopted by every one of its customers, but it will need another year yet before the work now being done by the electrical firms will show its effect to the full as they are pushing for flange mountings on the 1918 cars rather than for 1917 business, which is practically all closed.

Unit Ignition Increasing

The trend toward unit assemblies of generators with ignition distributers is very marked this year. Not only does this eliminate one of the drives from the engine, but with a normal sort of generator location it usually brings the distributer into a position somewhere nearly midway of the cylinders, so that the high-tension leads to the spark plugs can be short and direct. There is another small advantage, in that the timing can usually be made very exact, because the pitch of the fine teeth of the bevel or spiral gear drive for the vertical shaft will differ from that of the front end gear, thus offering a chance for a sort of differential setting.

The manufacturers of generators do not appear to have any preference with respect to the location of the ignition distributer. The demand for combining it with the generator appears to have come from the automobile manufacturer and it depends upon him whether this will be the most common type in the future. One tendency with respect to ignition units is worth noting. Two years ago a number of generators were being put out with the ignition breaker and distributer mounted on the end and appearing from the outside almost exactly the same as a magneto distributer. These types are still being made, but they are not being used to anything like the same extent as are the generators combined with a cylindrical distributer on a vertical shaft.

There are two reasons which may explain this situation. The first is that the provision of a vertical shaft on the end of a generator will allow a number of different kinds of distributers to be fitted, so a manufacturer need not purchase the generator and the ignition device from the same firm, even if he uses them in unit combination. The other is that the cylindrical distributer on the vertical shaft is usually less liable to be rendered inaccessible by manifolds or other parts on an engine.

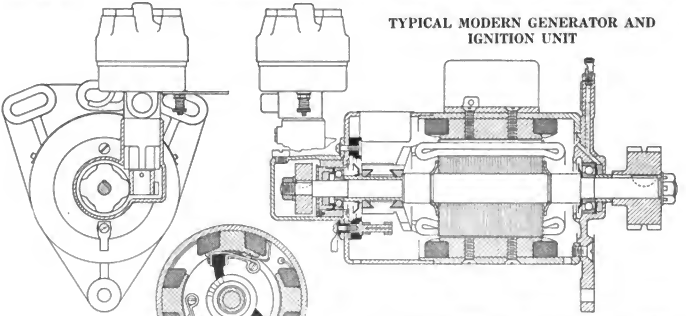
There is another point which is sometimes of importance in determining the choice of a unit generator and igniter. With the magneto type of distributer and contact breaker it is not usually so easy to carry the armature shaft out at both ends of the generator. When the vertical distributer is used it is quite easy to extend the armature shaft so that a water pump or some other accessory can be driven tandem with the generator. With a flange mounting for the generator and an armature shaft carried right through, a drive for a tire pump can be arranged very conveniently and the pump will not interfere with the accessibility of the distributer.

Fewer Regulating Systems

For holding the voltage steady throughout a very wide range of armature speed a large number of different schemes have been tried. Three years ago there was very little indication as to what would be the ultimate choice of manufacturers. Even a year ago it would have been hard to forecast the situation to-day, but it is now possible to state quite definitely that the third brush system of regulation is far the most popular and that the vibrator controller for either voltage direct or for current is second favorite.

It also appears now that we shall almost certainly see several systems of regulation continuing in use for many years. For very many purposes it is hardly possible to improve upon the third brush system. For cars having a big lamp load, a rather lighter machine can be built with a vibrator control, while the bucking coil and some other system of control are often preferred in special cases.

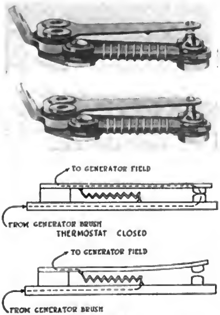
The action of the different controlling systems has been explained several times in The Automobile, but the two



TYPICAL MODERN GENERATOR AND IGNITION UNIT

This is a new machine introduced by the Dyneto Co. and is entirely typical of an up-to-date generator. It is a third brush machine and can be adjusted to give different outputs. The flange mounting is of the kind that the S. A. E. will probably standardize and the method of combining the ignition distributer is now being used by many.

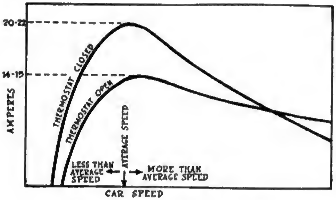
principal controls may be outlined briefly once again. There are two main brushes on the generator from which the current is taken and this current has two paths. One is the outside path to the battery, etc., the other is the internal path round the field magnets. Now, if we assume that there is 6 volts difference of potential between the main brushes we could regard one brush as being plus three and the other brush as minus three. If we apply a third brush midway between these two its potential would be zero. If, therefore, we take a wire from the third brush, wrap it around the poles of the field magnet and take it back to either of the two main brushes there will be a difference of 3 volts between the two ends of this secondary field magnet winding. This means that a current will flow through this second winding as well as through the main winding.



Photograph and diagram of connections for Remy automatic output regulating thermostat

As the speed of the armature varies the magnetic lines of force are distorted. At very low speed they go straight from pole to pole and as the speed rises they are dragged around by the armature so that they take up an angular position. The effect of this is to vary the potential at the point on the commutator where the third brush makes contact, so that the current flowing from the third brush to whichever of the main brushes it may be connected varies with the speed of the machine. It is possible so to place the third brush that the current from it will assist the excitation of the field magnets at low speeds and oppose it at high speeds.

The action may be compared to that of a fan placed in a flue from a stove. When the stove is burning freely we can set a fan to blow up the flue, thereby increasing the draft and encouraging the fire. When the fire is burning freely so that the natural draft up the flue is very strong, we could decrease the rapidity of the draft by reversing the direction of the fan and blowing *down* the flue instead of *up* it.



Effect of Remy thermostatic output control

It is obvious that, with this third brush system, the exact nature of the current produced from any one machine will depend upon the position of the third brush relative to the other two. If we want the generator to start charging at a very low speed we can set the third brush so that the current from it will assist the magnetization of the fields very strongly. If we want to reach the peak of the output of the generator at a higher speed we can move the brush so as to reduce or even entirely remove the assisting feature, letting it act only in opposition at high speeds. Thus the third brush machine has a possibility for adjustment. Nearly all third brush machines are so made that the manufacturer can adjust it, but very few indeed have an adjustment which is intended to be touched outside the factory. The reason for this is that the adjustment must be operated intelligently. It is a useless thing to anyone who does not understand its function. It used to be thought that the difference in the average lamp load between summer and winter would make an adjustment imperative, but this idea has lost ground steadily and has few supporters to-day. The reason is two-fold; first, batteries will withstand a greater degree of overcharging than they used to do, and secondly, generators are commonly so constructed that they produce the maximum charging current at fairly low speed and considerably less current at high speed. This means that the reduction in speed which accompanies night driving actually increases current output. Furthermore, with some of the vibrator controls, the output of the generator depends only upon the condition of the battery and, if the battery is full, the generator will deliver very little current, scarcely more than enough just to keep the battery in proper condition.

The Remy company, however, considers that some sort of differentiation is required for the sake of the battery, and it has recently developed a very interesting device for varying the charging rates between summer and winter. If the generator is made so that it will carry the winter lamp load it is bound to do a certain amount of battery overcharging in the summer and, although this may not do the battery any real injury it is bound to evaporate the electrolyte a little quicker than it would otherwise do.

The Remy idea is very simple and it consists of an automatic device controlled by temperature which switches a resistance into the field windings as soon as the temperature of the generator rises above a predetermined point, usually about 150 deg. The device consists of a pair of contacts normally kept together, one of them being mounted on a compound strip of two dissimilar metals. When temperature increases above 150 deg. this strip bends, so breaking the contacts and thereby throwing in the additional resistance coil.

The thermostat is mounted inside the generator, where it will normally be at about the same temperature as that prevailing throughout the coils and body of the generator. It is proposed by the Remy company to proportion the additional resistance so that the effect of throwing it in is to reduce the current about 30 per cent. An automatic device

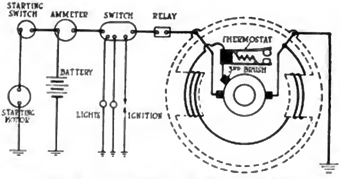
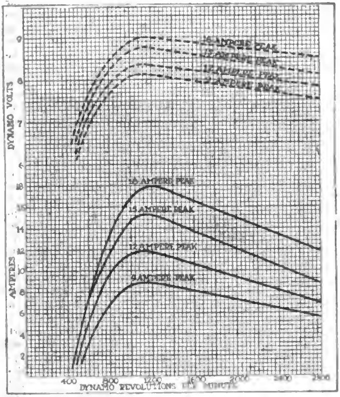
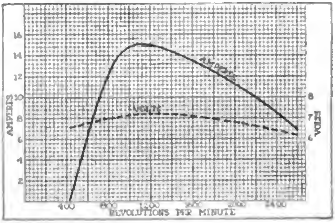


Diagram of connections with Remy thermostat

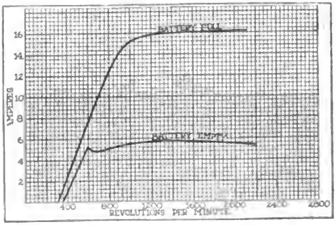
Characteristic Curves From Different Controls On Various Generators



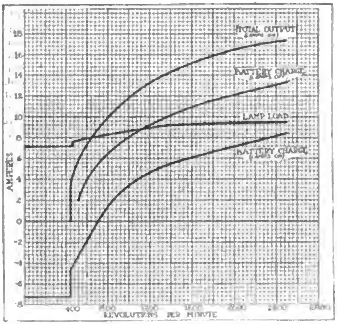
Voltage and ampere curves obtained from the same generator with third brush regulation obtained by altering the adjustment of the third brush. These give an excellent idea of the adaptability of this kind of regulation to various conditions, a very desirable feature



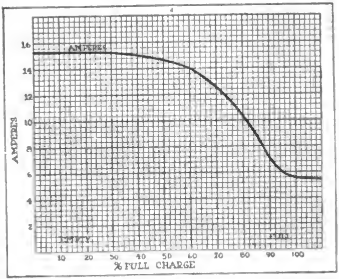
Characteristic curves from third brush generator plotted to a different scale



Shows how the state of charge of the battery affects the output from a generator with voltage regulation by vibrator



Bucking coil regulation curves showing characteristics, which, as may easily be seen by comparing them with the curves in the cuts appearing above, differ greatly from those of the third brush machine



Another way of showing the effect of the state of the battery on a voltage regulated generator. The curve is the output measured at successive intervals of time as the generator brings the battery from full discharge to full charge of this nature should have the advantage over anything requiring manual operation.

Several generator makers give directions in their instruction books for hand adjustment of the third brush and recommend its use, so it is quite probable that automatic or hand settings will return to favor in course of time.

Vibrator Like a Throttle

Vibrator control operates quite differently from the third brush system. In its simplest form there is an ordinary shunt coil passing from one main brush to the other and no subsidiary winding on the pole pieces. The shunt winding is connected permanently to one brush and its connection to the second brush is controlled by the vibrator. This vibrator is a spring reed furnished with contacts and with a small electro-magnet. The coil of this magnet is placed somewhere in the circuit so that if the current in it increases above a certain point the reed is attracted and the contacts either made or broken. With the reed in one position there is direct connection of the second brush to the end of the shunt winding, which means that as much current as possible will be flowing around the magnet poles. If this current becomes too strong, the reed of the vibrator moves and the change in the contacts thus caused switches a resistance coil into the shunt circuit. The effect of this is instantly to reduce the amount of magnetization, which in turn reduces the current. As soon as the current drops the reed of the vibrator is released and flies up, thus cutting out the resistance and returning the state of affairs to what they were immediately beforehand. This action is performed with great rapidity and, returning to our stove analogy, it is as though there was a valve in the flue which automatically closed as soon as the draft passed a certain degree of vigor. The instant it shuts the draft ceases and the valve automatically reopens only to shut again as the draft increases once more.

The vibrator control was developed previous to the days of the automobile, being used for other electrical work, and it was its great reliability in this service which suggested the idea that it would be satisfactory for automobiles. It has proved wonderfully reliable and has the advantage that it can be assembled as a unit separate from the generator itself. The vibrating reed, the resistance coil and the little electro-magnet are commonly all mounted in a sealed case which is attached either to the body of the generator or to some other convenient point on the car, although mounting on the generator is the most usual method. In the rare event of anything going wrong, the whole control unit can be replaced as easily as changing a spark plug. Comparing the two systems, the third brush is the simpler and the cheaper to make. It has no parts which can possibly fail or give trouble excepting the brush itself. The two drawbacks are that the characteristic output curve is not quite so close to the ideal as can be obtained with vibrator regulation, and the fact that there are three brushes instead of two is bound to make a slight difference in the rapidity of commutator wear. These two drawbacks, however, are extremely small and can be largely offset by a slight increase in size.

Little to Choose Between Systems

The vibrator controls enable the generator to be somewhat smaller and lighter and usually they will bring a discharged battery back to the fully charged state most rapidly. The drawback, if indeed it can be called one, is the presence of a moving part and contacts which are made and broken constantly, but since the life of the vibrator is apparently very much greater than that of the brushes and other parts of the generator this is a very small point. Thus, in weighing up between the two systems, when you consider the type of output curve and the weight and the cost it will often be found that there is very little to choose.

A point which has been very much discussed is the car speed at which the generator should commence to charge. This, however, is of small importance by itself. It cannot be considered alone any more than we can consider the diameter of a valve without any knowledge as to its lift and timing. The essential thing is to have such a generator and to drive it at such a speed that we can be sure of an output equivalent to the full lamp and ignition load at an average night-driving road speed. The practice of various manufacturers differs a good deal, but almost all of them find it necessary to provide this amount of current at a speed of 15 m.p.h. Some of them consider 12 m.p.h. is better. In any case it is between 12 and 15 m.p.h. that something approaching the full output of the generator should be reached. How much below 12 m.p.h. the cut-in should take place depends upon the characteristics of the generator. That is to say, it depends upon how rapidly it comes up to full output.

May Raise Generator Speed

The great majority of generators are now geared to run one and one-half times crankshaft speed. Whether this is going to be conventional practice for many years is debatable. More than one manufacturer of electrical apparatus considers that an increase in armature speed would be desirable because it would permit the generator to be smaller and lighter. The limitations of speed are almost entirely mechanical. With an engine capable of revolving 3000 r.p.m. we must be certain that the armature commutator, etc., will withstand prolonged running at 4500 r.p.m. if we are going to us a 1½ to 1 ratio. Using a 2 to 1 ratio would mean that the armature would need to be safe at 6000 r.p.m. Manufacturers have had to discover methods of construction which enabled the armature to be manufactured conveniently and which also provided strength to resist the considerable centrifugal forces at these very high speeds. When the construction of an armature, consisting of bundles of wires wound round a peculiarly shaped piece of iron, is considered, the difficulty of resisting the disintegrating forces becomes apparent.

Self-Lubricating Bearing Popular

There is very little trouble with bearings, the loads are so light that these seem to be able to stand any number of revolutions. Ball bearings are used very extensively in mounting armatures, but there is a noticeable tendency towards the use of plain bearings and a most successful type has been a compound metal and graphite bushing. It is necessary with plain bearings to be sure of an adequate supply of oil, and this is usually arranged for by a form of lubricator in which sufficient oil for a month or two of running is carried in a little cup or reservoir and transferred to the bearing itself by a wick. The wick will always supply the same amount of oil per revolution, thus insuring an adequate supply and preventing an over supply. The electric manufacturers' service stations report that two of the commonest troubles are bearing trouble, caused by absence of oil, and commutator trouble, caused by too much oil. The average owner of an automobile either over-oils or under-oils it. Hence generator makers are trying, with good success, to devise forms of lubricators, like the wick lubricators, which make over-oiling impossible and carry so much oil that an adequate supply is guaranteed even if fresh oil is added only very occasionally. Several manufacturers have continued to use ball bearings because of their ability to run when quite dry, but the compound bushing containing a little graphite can also be run dry for a reasonable time without much damage resulting so that the present tendency is certainly toward plain bearings. This seems rather curious in these days when ball and roller bearings are being used more and more extensively, but there are two reasons which make the plain bearings preferable. One is that it is incapable of making any sound, and the other is that the clearance between the armature and the pole pieces can be made rather smaller with plain bearings, which increases the electrical efficiency of the generator. However, we are getting small bearings of a greater and greater accuracy every year, so it will be very difficult to forecast what may be the eventual outcome.

Single Unit's Limited Field

The situation with respect to single-unit and two-unit systems is much the same as it was last year. That is to say, the trend toward the two-unit system is continued. The single unit which has but one driving connection to the crankshaft is giving excellent service and is still being used extensively on cars where the maximum of engine speed is not very great and where the cranking torque required is comparatively low. To give enough cranking torque a single unit in permanent connection with the crankshaft through a chain or gear has to be made larger than it would need to be did it operate as a generator only. It also has to run at a higher speed than would be the case were it only a generator. This is because the size and speed determine the cranking torque which the instrument can exert on the crankshaft.

Obviously, if we have a 3 to 1 gear ratio between the armature and the crankshaft we must have a much larger electrical machine than if we have a 20 to 1 ratio which is easily obtainable through the flywheel engagement.

This difficulty has been overcome in one or two cases by arranging a special form of drive so that the armature is driven at one speed when the machine is operating as a generator and at a much higher speed when acting as a motor. The best known example of this is, of course, the Delco system in which the armature is driven by the crankshaft from one end through an overrunning clutch and can be made to drive the flywheel from the other end, during which cranking period the clutch is in operation and the main drive is doing nothing, but electrically, this is practically the same thing as a two-unit system with the two units combined in one external casing. Possibly it is the great opportunities offered for patenting single-unit machines of this type and the impossibility of patenting two-unit outfits as such, which has encouraged the development of the two-unit system rather than of the "two speed" single unit. Undoubtedly, also, the two-unit system has been favored by automobile engineers because the generator is small and the motor so very small that it can be packed away in very little space.

As with almost every other new part of an automobile the design of the electrical equipment a few years ago was influenced largely by the demand for outfits which could be attached to engines originally designed to receive them. While this did not affect the electrical part very much, it did affect the mechanical detail profoundly, and it is really only now, at the commencement of the 1917 season, that it is possible to say the effects of this original influence have altogether vanished. Even now, however, very many generators and motors are being made to special designs because of the limitations imposed by the producers of old crankcase patterns. For instance, the inboard type of starting motor in which the Bendix pinion moves forward to engage the flywheel is simpler than the outboard pattern in which the pinion moves in the reverse direction, because in the former case it is only necessary to have the two bearings in the motor frame, whereas in the outboard type an additional casting with a third bearing the far side of the pinion is essential. It so happens, however, that the inboard type is difficult to apply to a good many stock engines with bell housing to the flywheel. Similarly with regard to the mounting of the generator, the geared centers in the front end fall very differently in different engines and this makes it hard to avoid the occasional use of special generator frames.

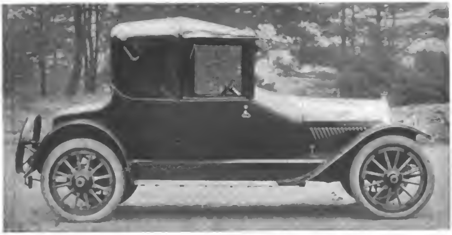
Time, however, will take care of things like this and we are within sight of the day when almost any stock electric generator and motor will fit almost any stock engine, a condition which is eminently desirable.

The application of either generator or motor to the side of the transmission case at one time appeared promising, as it frees the engine of a bulky part, but there is no indication whatever that this idea is likely to be considered except in a very few isolated cases. Probably on the engine is the best place for the generator, as it is most accessible there and well protected.

Steady, Sane Progress

Summing up, therefore, it appears that the electrical equipment record for 1916 is one of sane, steady progress without any prominent high spots. Changes have been mainly of the "settling down" kind; the elimination of peculiar or odd designs and a general bettering of manufacture. More real development work has been done with battery ignition where there have been a good many changes and a good many new things, and these will be dealt with in the next issue of THE AUTOMOBILE.

New Cabriolet on Oldsmobile Eight Chassis



New Oldsmobile four-passenger cabriolet mounted on the eight-cylinder chassis. It sells for $1,775

LONG low lines, flowing curves and German silver radiator with silver finish on lamps, hub caps and door handles are individual touches of the new cabriolet body mounted on the Oldsmobile eight chassis built by the Olds Motor Works, Lansing, Mich. The collapsible top has no exterior braces and can be handled from the inside by one man. Doors are substantial with large rattle-proof adjustable windows. The driver's seat is 15 in. in advance of the main seat which accommodates two passengers. A folding seat pivots under the cowl. The car sells for $1,775 f.o.b. Lansing. The compartment behind the driver's seat is of ample dimensions and can be used for parcels, gloves and other things of that sort.

Denmark — A Good Car Market

American Cars Are Rapidly Establishing Excellent Reputations for Economy and Durability—Field Should Be Further Developed —Industrial Conditions Similar to Those in the United States

DENMARK to-day presents one of the most rapidly growing markets for American-built automobiles and motor trucks, according to Knud A. Mammen, New York manager of Mammen & Drescher, dealers in American cars in Copenhagen. Mr. Mammen states that there are over 30,000 cars in use in Denmark at the present time, as compared with less than 2000 in 1912. The great bulk of these are passenger cars, there being comparatively few commercial vehicles, although there are some 200 taxicabs, which are not fitted with rubber tires, due to the high prices now prevailing for these in the Scandinavian countries.

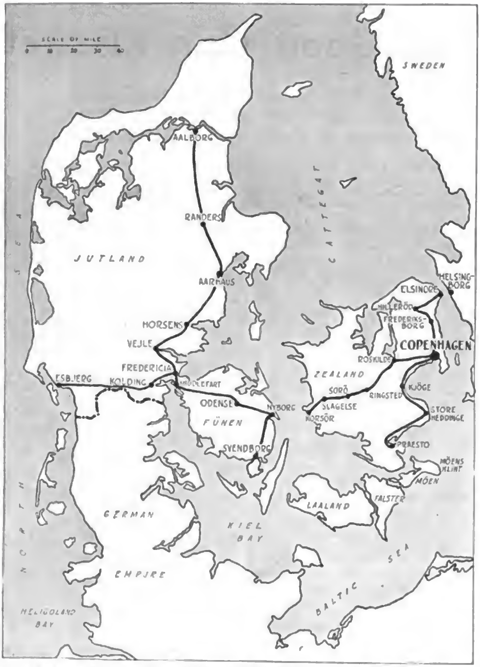
Industrial conditions in Denmark at the present time are very similar to those in the United States, certain commodities having risen rapidly in price in consequence of the demands of the warring countries. Naturally a large number of people have profited by these developments, with the result that a new wealthy class has been created, the members of which have been dubbed by the general public "goulash barons." These people have been and still are large buyers of automobiles. In addition, farmers have profited by the high prices now paid for their products to such an extent that the majority of them have bought cars. Moreover, the Danish people have only recently awakened to the possibilities of the American car, and the normal demand has been growing at a rapid rate. An example of the interest displayed by the people of Copenhagen in United States of America cars was mentioned by Mr. Mammen, who said that two months ago he drove a new four-passenger American-built machine through the streets of the city one morning and that afternoon over twenty prospective car buyers came into the company's salesrooms with the cash in their pockets to pay for a machine on immediate delivery, but, of course, it was impossible to furnish what they wished at that time. Most of these people subsequently became owners of cars of that make in either the model they had admired or in some other style which appealed to them on making a further investigation. About three months ago similar conditions prevailed, every automobile dealer in Copenhagen having sold out his entire stock, and people were coming into the salesrooms every day with rolls of money to pay for cars which were not available on any terms.

KNUD A. MAMMEN

Difficulty of securing shipping accommodations due to war conditions has been one of the greatest handicaps with which the exporters of American automobiles have had to contend. Mammen & Drescher, who handle Chandler, Pathfinder, Haynes, Elcar, and Singer cars, Chase and Duplex trucks, and Knox tractors, in addition to Fisk and other American tires, found that it cost them between $500 and $600 each for the larger cars when these were shipped crated, not including crating and carting and freight from the factory. By arranging with the factory to ship them the chassis knocked down and without bodies the firm effected a saving of 80 per cent. on the freight of each car. Upon the arrival of the chassis in Copenhagen they are taken to the company's shops and fitted with bodies of the European type and more in keeping with the desires of many of the purchasers than the standard American-built bodies appear to be. An interesting development of the present era of nouveaux riches in that country is that the so-called "goulash barons" desire the bodies of their cars to be something out of the ordinary, and, as their tastes have not been very highly developed in this regard, the results are frequently grotesque. Sometimes they content themselves with a few flourishes of external ornamentation and perhaps a strikingly vivid coloring, and in other cases they order unusual and impractical body shapes. In the matter of interior arrangement of seats, color, and type of curtains, window operation, etc., they often demand the impossible, but are finally content to accept some approximation of their ideal, if the body builders cannot persuade them to accept a more

A. H. ANDERSON

¶EDITOR'S NOTE:—Our manufacturers of cars, trucks and accessories have frequently been informed that now is the time to develop and establish a world market for their products which will endure after the close of hostilities in Europe and many of them have taken advantage of the opportunities now offered for export trade. This article, based on data furnished by Knud A. Mammen, New York manager of the Copenhagen firm of Mammen & Drescher, and A. H. Anderson, chief engineer of the same concern, gives an inkling of the propitious conditions to be found in Denmark.



MAP OF DENMARK, SHOWING SOME OF THE MAIN AUTOMOBILE ROADS

Touring is very good in Denmark, although the distances are of course small as compared with those in the United States. Roads are excellent, macadam and bituminous-surfaced highways preponderating. Those indicated by the black lines on the map are only a few of the more important thoroughfares connecting some of the leading cities of the country, but there are a great many more roads which have all the advantages offered by these and at the same time possess even greater scenic attractions. This is especially the case in the northern part of Jutland where some of the finest touring imaginable is to be found. Connections between the various islands of Denmark and also with the peninsula of Jutland are by ferries and the water trips lend a great deal of variety as well as giving some glimpses of very fine coast scenery. These conditions, coupled with the increasing prosperity of the country and the leaning evinced by the people of Denmark toward American cars, make that country a rich field for the American manufacturer

conventional but less conspicuous design for their machines.

An idea of the difficulties to be overcome in shipping cars from the United States to Denmark under present conditions may be gained by reviewing the necessary routine and red tape through which exporters are obliged to go before the cars are allowed to leave New York harbor. The Merchants' Guild in Copenhagen gives a declaration for orders which have to be viséed by the British Consul and by the Automobile and Cycle Merchants' Association, which is somewhat similar to the National Automobile Chamber of Commerce in this country. The matter then goes to the Scandinavian-American steamship line, which is the only one carrying American automobiles direct to Denmark. The steamship company cables to the agents in New York who handle its shipping from this country. These agents then notify the exporter what accommodations can be obtained for shipping the cars, giving ship, date, etc. It is then necessary for the exporter to write to the British Embassy at Washington, giving complete details of the order and describing all matter to be shipped thereunder, and also giving the names and addresses of consigner, consignee, etc. Upon receipt of an assurance for the goods and a permit from the British Embassy the cars can then be placed on the dock, after which shipment is a mere matter of routine with the steamship company.

Shipping Improved

For about two years after the beginning of the European war automobiles could be shipped to Denmark only on freight boats, and frequently it was impossible to secure space on any of these for long periods at a time, due to the enormous quantities of war munitions which were being sent abroad for the use of the belligerent nations. Now the situation is greatly improved, not only because the exports of munitions have greatly decreased in volume, but also because passenger boats are now available as carriers of automobiles and motor trucks.

Tires Hard to Get

The restrictions enforced by Great Britain upon the shipment of rubber, including tires, to European countries naturally constitute another handicap on the exporter of cars from the United States to Denmark, because it is not only impossible to ship machines fitted with tires, but it is also exceedingly difficult to secure tires with which to equip them when they have arrived in Denmark. All tires must pass through London, and the strictest sort of supervision is exercised in England and also in Denmark to prevent the tires, or, in fact, rubber, in any form, from reaching Germany. For some time after the outbreak of hostilities unscrupulous persons took any means of securing tires, which they could sell in Germany at very high prices. When they were unable to obtain a sufficient quantity by buying in the open market or through private channels they stole them from cars and shipped them to Germany. To check these practices a system was developed by which no one could buy a new tire without turning in the old one on the deal.

Showrooms of Mammen & Drescher in Copenhagen, Denmark. These are situated in the business district near the station through which the prosperous citizens make their daily trips between home and office. Note the American-built cars at the curb ready to give demonstrations, for which they are usually in great demand

The importance of the first impression made by an American-built car on the market in Denmark is evident from the experience of Mammen & Drescher, as cited by Mr. Mammen, with the first machine the firm imported from this country. This car, a Chandler six, took part in a big reliability run held soon after its arrival in 1914, and made an enviable showing under particularly adverse conditions of weather, road, etc. As a result a demand immediately sprang up for these cars, and that particular machine has been sold three times, the owner each time turning it in for a new car. Similar experiences with the other American cars the company handles have confirmed them in their belief that it pays to demonstrate the good qualities of the machine for the benefit of the Danish public, which has never had very much experience with American automobiles until the last two or three years.

There are too many automobile dealers in Copenhagen, Mr. Mammen says, who know practically nothing about the cars they sell. These dealers cannot give satisfactory service to the people who purchase their cars, and the natural result is that the machines they represent acquire a reputation as unsatisfactory in various ways. The same situation does not exist with regard to tires and accessories, as the dealers are more familiar with these and seem to handle the service matters in regard to them more satisfactorily than for the cars.

No Automobile Row

There is no automobile row in Copenhagen, which is the largest city, the capital, and the most extensive automobile market of any part of Denmark. The various salesrooms, garages, service stations, shops, etc., of the dealers in automobiles and accessories are spread over the business, and part of the residential, section of the city, and apparently only a few dealers have been thoughtful enough to secure locations advantageous from the viewpoint of passing traffic, etc. The salesroom of Mammen & Drescher, which is illustrated on this page, is fortunately situated, Mr. Mammen points out, being so placed in the business section of the city that practically all the prosperous citizens who are legitimate prospects as car buyers must pass it on their way to and from the station on their daily journeys between their offices and their homes in the suburbs or outlying residential districts.

American cars are now most popular of all in Denmark and bid fair to continue so after the close of the war, owing to their low price, durability, simplicity, and ease of upkeep. The possibilities of this country as a field for the United States of America car manufacturer are very great at the present time, and, if properly developed, the trade of our automobile industry with Denmark should grow to very large proportions in the future. When it is realized that the twenty islands and the peninsula of Jutland, which constitute Denmark proper, have a population of approximately 3,000,000, that the city of Copenhagen alone has over half a million people, and that there are about a dozen other cities with populations ranging from 10,000 to 70,000, it is readily seen that here is a field which our makers should not neglect. Then, too, the influence of good reputations established by American-built cars, trucks, and accessories in Denmark will have a very considerable effect in facilitating the development of our business relations with the insular possessions of that country.

American cars have had little competition to meet in Denmark during the last two or three years. Shortly after the outbreak of the war a number of persons, perceiving the increased demand for automobiles in the country, went to Germany and bought up all the French, English, Italian, and other cars they could secure and sold them at a big profit in Denmark. There is a car called the Scania-Vabis which has been sold in large numbers in Copenhagen and other Danish cities since the outbreak of the war. This car is made in Denmark from parts imported from Sweden. It is a rather heavy car and the output is necessarily small, so it does not offer very serious competition to dealers in American cars.

Money Easy to Get

Industrial conditions in Denmark at present are very similar to those in this country. The banks are in excellent condition and money is easy to get, so that dealers have no difficulty in securing financial backing. Thus cars can be sold on the time-payment plan if desired, though there is at present very little call for this arrangement in that country. As Denmark is primarily an agricultural center, the high prices for farm products which the war has caused are responsible for the widespread prosperity to be found among the Danish farmers, who, Mr. Mammen says, are buying cars fast, Fords predominating. No fat or butter is allowed to go out of the country except to England but the large fishing industry of Denmark has profited enormously from the war as it furnishes fish not only to England, but also to France and Germany. There are practically no cattle to be seen browsing in the fields, as an enormous number have been killed and the meat sent to Germany and those remaining are carefully guarded as beef sells for about $1 per pound. Other farm products have increased in price to a marked degree during the past 2 years; milk is 4 per cent higher than at the outbreak of the war and wool 100 per cent higher; butter costs 60 cents per pound, and all meats are far more expensive. Naturally the high price of wool and other cloth-making materials has had a great effect on the price of clothes, which are considerably more costly in every particular than was the case in that country 2 years ago.

One phase of the situation which must not be overlooked by the American manufacturer is that the farmers, attracted by the high prices paid, have sold practically all their horses for war purposes and these men are almost all logical prospects for the sale of American-built farm tractors and motor trucks.

All Plants Rushed

In the manufacturing field all the aeroplane, war munitions, and textile factories in Denmark are doing an enormous business and the stocks of these companies have soared to remarkable heights. Ammunition supplies and machine tools for factory equipment are produced for Russia in tremendous quantities besides a large output to other countries. The stock of one concern manufacturing these goods sold at $45 a share in 1914 and it is now quoted at over $530. The securities of shipping concerns have also had a rapid rise, the $100 par stock of one company being quoted at over $1,700.

Business morals have declined in Denmark in company with those in other European countries not involved in the great war. People realize that existing conditions are only temporary and many of them have made up their minds to make their fortunes quickly and without particular regard as to the means employed.

A Fine Touring Field

Denmark presents an unusually attractive field for touring and the roads are very smooth and well kept, being largely of macadam or bituminous surface. There is at present a law in effect which prohibits the use of all side roads by cars of over 2000 lb. This has no effect on the smaller cars and only restricts the larger ones to the main highways, which is a hardship only in so far as missing delectable bits of scenery in out-of-the-way places are concerned. It is very probable that this law will be repealed before long.

Roads Are Excellent

Of course all the islands as well as Jutland are covered with a network of good roads but some of the more important ones are indicated in the map on page 926. The country inland is rather flat but along the coasts there are magnificent stretches of rocks and cliffs, the latter being of white chalk in some instances as at Klint in the island of Möen. There are numerous beautiful boat trips between the islands, and in passing through the inland sections of beech woodlands and little lakes overhung by trees present a continuous variety to the neatly fenced fields and cozy cottages. In Northern Jutland there are some particularly lovely bits of scenery in the neighborhood of the chain of lakes running from Aalborg, a city of some 40,000 inhabitants, to the western coast.

Prospects in the Cities

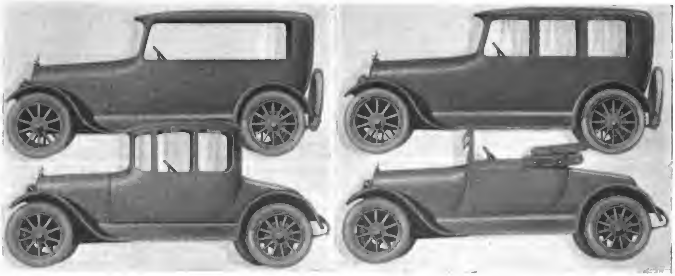
Some of the leading cities of Denmark which offer possibilities to the American car manufacturer are the following, as indicated by their approximate population:

Copenhagen	500,000	Randers	24,000
Aarhaus	70,000	Vejle	15,000
Odense	45,000	Elsinore	14,000
Aalborg	40,000	Fredericia	13,000
Horsens	25,000	Svendborg	12,000

To Assemble a Car

Mammen & Drescher are preparing to assemble a car in Denmark under their own name from standard units bought in the United States. This car was designed by A. H. Anderson, chief engineer of the firm, who is now in Denmark arranging for the handling of the first 500 chassis, parts for which will be shipped to the company's shops in Copenhagen as soon as the necessary preliminaries have been attended to.

Smooth Lines in Moon Closed Models



SUPPLEMENTING the report of the new closed models brought out by the Moon Motor Car Co., St. Louis, Mo., which appeared in a recent issue of THE AUTOMOBILE the above illustrations give an idea of the smooth lines and neat finish of these cars. That at the upper left is the seven-passenger sedan mounted on the 6-66 chassis and selling for $2,250; Below it is the four-passenger coupé on the same chassis and listing at $2,150; at the upper right is a view of the sedan as a closed car, the windows and pillars being folded out of sight in the other view. Below at the right is the cabriolet design which, like the coupé, seats four, and which sells for $1,850 on the 6-43 chassis and for $2,150 on the 6-66. The interior appointments of these bodies are in keeping with their exteriors.

Many Factors in Brake Design

Tire Adhesion, Road and Wind Resistance and the Personal Equation—Brakes on Two Wheels Are Enough

By John Younger

¶EDITOR'S NOTE:—Paper read by John Younger, chief engineer of the truck department of Pierce-Arrow Motor Car Corp., before the Pennsylvania section of the Society of Automobile Engineers Nov. 22.

DURING the past 2 or 3 years emphasis has been laid on the accelerative ability of cars. Designers have vied with each other in getting the last fractional inch per second, per second into their performance curves. Advertising managers have not been slow in accelerating the peaks a little further and finding that the public liked it.

Get away, Pick up, Dash, Verve—I have myself called it Elan—are all familiar terms for the engineer's word acceleration. There is as yet no term of endearment for retardation. Its significance has not gripped the people's imagination, and yet of the two it is of more vital importance. The automobile death rate increases in inverse proportion to the efficiency of the retardation curve.

In fast rail traffic, with many stops, the possible retardation curve is first studied. Running a continuous stream of cars through New York subways, with an infinitesimal headway at rush hours, has caused their engineers to know almost to a fraction of a foot just where the brakes must be applied to stop at the required point at a station.

Similarly in street car work: The profit that can be derived from a set of rails in a busy district is as much a question of retardation as of acceleration. The automobile moving rapidly in and out of city traffic places, perforce, great dependence on its brakes, and actually good braking contributes greatly to the feeling of liveliness. A car with good acceleration, but sluggish retardation, does not feel as lively as one with both good.

Co-efficient of adhesion of average rubber tire, with good macadam, asphalt, concrete or brick road, 0.5.

Maximum retardation car should be capable of 10 ft. per sec. per sec.

Usual retardation for slow down or stop, 6 ft. per sec. per sec.

With pedal push a man can exert in properly designed seat, 300 lb.

With lever pull a man can exert on brake lever upward of 100 lb.

Efficiency of average brake linkage allowing for usual weak system of lubrication, about 75 per cent.

Radiation that should be provided for long hills, about 200 B.t.u. per minute per ton weight of car.

Retardation can be studied under two heads:

A—Retardation relative to the road.

B—Retardation relative to the forces acting on the car.

The primary object of the former is to slow down and actually stop the car.

The object of the second is to maintain the vehicle at a steady, safe speed, notwithstanding the forces, such as effect of gravity on a hill, that are tending toward acceleration. Both actions have special characteristics which will be taken up separately.

Tire Adhesion Figures

Obviously, the first consideration is the boundary between the car and the road—the co-efficient of adhesion or friction of the tire. This varies greatly; the shape of the tire, the nature of its tread, whether it be solid or pneumatic; the compound of rubber used, play their share in varying this; and the very fact that the road surface ranges from cement or vitrified brick to greasy mud makes us realize how impossible it is to give figures which mean anything. Curiously, pneumatic tires have a co-efficient differing from that of solid tires, the writer having found it sometimes higher, sometimes less.

George Watson, before the English I. A. E., January, 1916, gives 0.4 as the maximum adhesion of solid rubber tires on good macadam. Other authorities state that 0.6 is the figure for pneumatic tires. The writer has found an adhesion of 0.6 for solid rubber tires on cement and vitrified brick roads, and only 0.5 under similar conditions for pneumatics. The measurement of tire adhesion is, however, inextricably mixed up with that of road resistance, the number of factors entering in being exceedingly large. A convenient and accurate standard to assume is 0.5, and this is concurred in by several authorities.

I have been careful to use the term adhesion in the foregoing as specially applicable to the case where the tire does not slip relatively to the road. When the tire slips the proper term is friction. There being no relative motion between the surface of the tire and the road (the road moving back at the same speed as the tangential velocity of the car), it is obvious that the case is analogous to the body at rest on an inclined plane. The co-efficient of stiction or adhesion is greater than that of friction. Incidentally, this partly explains why a car stops more rapidly when the wheels are kept moving than when they are locked.

Road Resistance

Nature has been very good on the whole. Smooth asphalt, concrete, brick, good macadam, which offer little resistance to the passage of the car, have fortunately a good co-efficient of adhesion when dry, thus offering fair compensation. As is well known, road resistance ranges from 5 lb. to over 300 pounds per ton. It is a factor which must be considered in the study of retardation.

Wind Resistance

This may very conveniently be taken as 0.002 Av^2 in pounds, where A is projected frontal area in square feet, usually about twenty-five square feet. Again, this is a variable depending on wind velocity and direction. Strictly speaking, it should always be considered, but its effect is small and may be left out in comparison with the other important items.

Possible Retardation

Given brakes on all wheels, and neglecting road resistances, we would have a retarding force of 0.5 W.

Whence from the inertia formula $F = \frac{W a}{g}$

we have the retardation $= 0.5\,g$

or 16.1 feet per sec. per sec.

The average car has, however, the brakes on the rear wheels only. Its weight is distributed equally on front and rear wheels as a rule.

The retarding force is then $\frac{0.5\,W}{2}$ and thence

the retardation is $0.25\,g$

or about 8 feet per sec. per sec.

With this latter we have that

	Stopping time.		Stopping distance.	
A car going 60 miles per hour....	11	Secs.	484	Ft.
A car going 30 miles per hour....	5½	Secs.	121	Ft.
A car going 15 miles per hour....	2¾	Secs.	30¼	Ft.
A car going 5 miles per hour....	.625	Secs.	4½	Ft.

The presence of road resistance, wind resistances, and chassis losses will bring this figure of 8 feet per sec. per sec. up very closely to 10 feet per sec. per sec. deceleration, so that a car traveling at 30 miles per hour will stop in 4.4 seconds and cover about 97 feet.

Comfort in Brakes

Everyone has experienced the peculiar feeling of being shot forward in the seat when brakes are suddenly and strongly applied in railway train or street car. The eyes have not prepared the body to brace up against the action, whereas in an automobile the eyes are usually on the alert and the body is well prepared for violent retardation.

Yet, in railroad service the best stop is that recorded in March, 1914, when a Pennsylvania train experimenting with a new type Westinghouse brake stopped in 1000 feet from a speed of 60 miles per hour. This took 22¾ seconds and was a retardation of only 3.87 feet per sec. per sec.

Experience has shown that an acceleration or deceleration of 6 feet per sec. per sec. is about all that can be borne in comfort by passengers. There are naturally many who cannot even bear this, and many who can bear much more. It is interesting to note en passant the terrific velocities that man can stand, but the very small changes in it.

Extreme change, such as stoppage against a stone wall, will catapult passengers out of their seats with great violence. Six feet per sec. per sec. is on the verge of discomfort; it is, I think, reasonable to believe that 10 feet per sec. per sec. is the maximum that should be cared for. This, by the way, is equivalent to an applied horizontal pressure on the passenger of about one-third his weight. So with the chassis. The inertia effects on the body fastenings, engine and transmission fastenings are usually based on the acceleration at low speed, and this is very rarely more than 10 feet per sec. per sec., the equivalent of a 30 per cent. grade.

Four-Wheel Brakes

It is thus seen that for the average vehicle there is little to gain in putting brakes on more than the two rear wheels. It is true that they could be so adjusted that the braking friction were only half what it might be, but this is exceedingly difficult to determine and keep in adjustment, and there is real danger in excessive retardation being produced under the normal circumstances of driving over dry roads. Railroad conditions are not analogous, as a co-efficient of adhesion of 0.2 is about all that can be reckoned on against our 0.5 to 0.6 on rubber-shod automobiles.

Two-wheel brakes, provided they function properly and are used intelligently, will give all the retardation that it is safe to use. This is not, of course, the only reason why all-wheel brakes have not been adopted generally, but it is one of them.

Truck Brake Considerations

The foregoing remarks have dealt mostly with a car whose weight is distributed equally fore and aft. The passenger load is usually a small percentage of the gross weight, and there is an obvious limit to the human capacity of the space. The truck is often twice as heavy when loaded, and overloading to the extent of double the rated amount may occasionally be met with, though this evil is, I think, getting less.

There are still a few trucks whose load is more or less balanced between front and rear wheels, but they are in the minority. The load is most usually carried 75 per cent. and upward on the rear axle, and it is this the designer must pay attention to. The weight of a truck is in no proportion to its load. A two-ton truck with body may weigh 6000 pounds, or 1.5 times its load, whereas a five-ton truck with body may weigh 10,000 pounds, or equal to its load.

Each truck, therefore, must be considered individually, and the final braking effort on the circumference of the rear wheels be made equal to at least 0.5 times the loaded weight at the rear wheels. Assuming the speed of the truck at fifteen miles per hour, this will stop the truck in about thirty feet, without causing the load to pile up behind the driver's seat. This should be short enough for any board of councilmen, and should preclude the necessity for providing safety guards or fenders.

The Personal Equation

The human element in producing retardation is very great. Brakes must be skillfully applied, so that under varying road conditions the pressure is just enough to not lock the wheels, otherwise a dangerous skid might result. Women are driving cars in increasing numbers. They are unable to exert the same pressure on pedal or lever that a man can. Designers must awaken to this problem. If a light pressure is given, brakes must be adjusted more often, unless some mechanical or electrical means be supplied for assisting the human strength. As stated, this must be very delicately arranged to give perfect gradation of pressure, but the problem should not be impossible of solution.

Continuous Braking

The question of absorption of energy has been ignored in the foregoing, inasmuch as the time interval is short, and the material surrounding the brakes well capable of taking up the heat developed. On a long hill, where brakes are applied continuously, the problems that arise are different. Here there is no question of inertia effects, or of skidding, or of stopping space available; the great question is one of absorption of energy and hence radiation of heat.

At the top of a hill a car possesses both kinetic and potential energy. If at the bottom the car's speed is unchanged, then the brakes, plus the road resistance, have absorbed the potential energy. The weight of the car plays an enormous part in this, the absorption of energy being in direct proportion to it. Whilst the truck lacks the speed of the touring car, it makes up for it by weight in hill descents, and the retardation problem is the more difficult.

A Specific Hill

There are many hills 10 per cent. grade and one-half mile long. A five-ton truck, gross weight 20,000 pounds, has a gravitational component down hill approximately 2000 pounds. Assuming a road resistance of fifty pounds per 2000 pounds, or 500 pounds gross, we have a net force tending to accelerate the truck down hill of 1500 pounds.

If a safe speed of ten miles per hour is maintained the time of descent is three min. The energy absorbed by the brakes is 1500 x 2640 ft. lb.

Or at rate of 1,320,000 ft. lb. per min.

Or 40 H. P.

Or 1700 B.t.u.'s per minute.

Take now the fact that approximately fifty pounds of metal with a specific heat of 0.12 absorb this, we have enough heat generated in three minutes (neglecting radiation) to raise the temperature of the mass from 60 deg. Fahr. to 900 deg. Fahr.

In a practical corroboration it was found there was one square foot of radiating surface from which the balancing temperature was calculated to be about 760 deg. Fahr.; the surface at the foot of the hill was certainly nearly that, being a black heat.

There are hills much worse than this in length and grade, the only salvation being the use of the engine, alternating with hand and foot brake. For the great majority of touring automobile work the normal brake is satisfactory, but for hilly and mountainous districts there is still much to be done. European designers have been well aware of this, some of the Italian designers whose testing grounds were the Swiss Alps have even gone the length of water cooling their brakes, both by drip and by waterjacket.

Auxiliary Brakes.

Only one truck, and that one of Swiss design, has attempted to solve this problem, and that by means of a device which shifts the camshaft longitudinally, converting the engine into what is really a two-cycle air compressor, the carburetor being shut off and fresh air admitted through a manifold port.

From time to time brakes working on a hydraulic principle have been devised, but always there has been the problem of cooling the liquid and insuring the tightness of pipes and joints.

It is the writer's impression that as the country roads get opened up more, and trucks are used in outlying districts, a demand will arise for a third brake for hilly districts. This will enable the vehicle to coast down a long incline at a predetermined safe speed, with no wear and tear on the engine or undue heating of the brakes.

Discussion of the Paper

At the meeting the chair was taken by B. B. Bachmann, and although the attendance was not very large it was obvious that every member present was very keenly interested in the paper. The discussion was opened by A. Ludlow Clayden, engineering editor of THE AUTOMOBILE, who took up the subject of brake materials, asking whether Mr. Younger had any data with respect to their relative qualities. He pointed out that the usual kind of brake lining is a fairly good heat insulator which means that most of the heat generated in the brake has to be dissipated by the drum since the brake band or shoe is to some extent insulated by the lining. He said that metal brake surfaces were still the most extensively used in Europe and that all kinds of materials had been tried. Cast iron is the most usual but phosphor bronze has been used, and one brake for which great claims were made had the shoes faced with alternate sections of different materials. Trials were made with half the brake surface cast iron in sections about 2 in. by 2 in. and the other half phosphor bronze, white metal, aluminum, and, finally, compressed asbestos fabric.

The last time the speaker had any information from Europe regarding this brake the cast iron and fabric segments were proving very satisfactory, it being stated that the bonding material in the fabric seemed to spread a little over the iron, preventing rust. Also, it was said that the brake operated without the scrape usually associated with a plain iron brake.

Another point which is not often appreciated is the great theoretical advantage of diagonal braking. This consists of having brakes on all four wheels, so connected that one control operates the right front wheel and the left rear wheel simultaneously, the other control operating the other pair. The object of this layout is that as soon as either the front or rear wheel ceases to revolve it loses its power to direct the line of motion of the car. If both back wheels or both front wheels are locked the car is unsteerable, but with diagonal linkage it is possible to lock one pair and still have one wheel on each axle rolling freely and therefore available for steering.

The disadvantages are purely mechanical, the link system becomes very complicated and the brake is costly.

L. Goldmerstein, editorial staff, *A. S. M. E. Journal*, supported Mr. Younger's contention that it would be essential to have two sorts of brakes, one intended for rapid stopping and the other for the descent of long grades. He described a possible form of brake with which he has been experimenting wherein power is absorbed by a reciprocating piston which draws oil into a cylinder and then expels it through a small valve, the lift of which is controllable. This raises the temperature of the oil and the heat can be dissipated by any convenient means. One way he suggested was to extract the heat by making the oil do work such as the driving of a fan.

Regarding the conductivity of linings, this undoubtedly was very poor but the most remarkable fact was that the conductivity decreased as the intensity increased. The soft linings were much better conductors than the hard ones. This doubtless was due to the action of the air which would be contained in considerable quantities between the meshes of the softer fabrics.

Truck Brake Requirements

E. R. Whitney, chief engineer, Commercial Truck Co. of America, said that in designing brakes for trucks it was essential to make them so that a considerable effort was required to apply them. At one time he said his company had fitted a brake of exceptional power and discovered very quickly that truck drivers were using it so viciously that severe damage was being done to the mechanism generally

In his reply Mr. Younger said that he agreed entirely with the last speaker and that he had discovered a brewery truck driver, whose services he had enlisted for the purpose of experiment, was able to exert a pedal pressure of 400 lb. Regarding brake materials, it was undoubtedly a fact that the usual linings were good insulators and this he thought accounted for the rapid wear on brake drums with cars used in mountainous districts. He pointed out that with an internal and an external brake on the same drum all the radiation from the drum is limited to its inner edge and said that he had known a case where the drum had got so hot that it had parted all around the edge, the ring separating from the disk. Cases where the spokes of a wood wheel had been blistered were also not uncommon. Up to the present he had not been able to find any material better than cast iron for facing the shoe of the propeller shaft brake on a truck.

Drum Surface a Factor

One important thing which seldom received any consideration, was the nature of the surface of the brake drum. Evenness of wear he said was affected profoundly by the nature of the surface when the drum was new. If the brake drum is merely turned it is left covered with minute but very sharp points and these exert an unnecessary cutting action on the shoes or band. If the surface of the drum is ground to a fine polish the surfaces will last longer.

Concerning Mr. Goldmerstein's remarks about the conductivity of fabric, this explained something which he had noticed and which had puzzled him. This was that the softer linings appeared to suffer less from prolonged heating, as in the descent of a mountain, than did the heavily compressed fabric, although the latter was much more durable in ordinary stopping service where long grades were not encountered. After prolonged heating, the compressed fabric appeared liable to disintegrate in some way.

Alcohol—The Fuel of the Future

Enormous Demand for Gasoline Makes Alcohol and Benzine Potential Developments for Automobile Engine Fuel—Utilization of Wood Waste Offers Vast Supply

By Bernard N. Glick, M. Sc.

¶EDITOR'S NOTE:—As previously pointed out by Mr. Glick in his article on the manufacture of gasoline from casing-head gas, the increasing demand for gasoline for automobile fuel renders the development of other fuels imperative. In this article the author reveals many interesting possibilities in the production of alcohol and benzine suitable for fuel purposes, dwelling especially on the enormous supply of wood waste as a source of alcohol.

WITH approximately 3,000,000 motor vehicles doing duty in the United States, from 1,000,000,000 to 1,200,000,000 gal. of gasoline have to be provided annually to keep them running. There are unmistakable signs that the production of this enormous volume of gasoline will become increasingly difficult and as a consequence there is in the minds of many automobile engine students the vague thought that gasoline, while the fuel of to-day, may have to give way to some other product to-morrow. In this connection it is comforting to know that there is a substance already well known, which can take the place of gasoline and run these automobiles just as efficiently, and perhaps more so.

The substance that thus stands out predominantly as the fuel of the future is alcohol. This product has long since passed the stage where its suitability was questionable, the only thing retarding its adoption being its high price, due to the raw materials now used and the limited use to which it is put at present. With a growing demand, such as will arise when the price of gasoline becomes abnormally high, we anticipate a search for cheaper methods of production and for raw materials which will give it in sufficient amounts to meet the enormous demand that will exist for a suitable fuel for internal combustion engines.

The question of the suitability of alcohol as a source of power in internal combustion engines has been sufficiently established by long series of tests conducted by various groups of experimenters. The United States Bureau of Mines has done magnificent work in this direction and many of the following figures comparing gasoline and denatured alcohol are taken from the results of their painstaking efforts to help solve the fuel problem of the future. Although the calorific power of alcohol is little more than one-half that of gasoline —about 11,160 and 20,900 B.t.u. per lb. respectively—its greater efficiency—alcohol 28 per cent; gasoline 16 per cent— compensates for this. This higher efficiency of alcohol is due to various causes, chief among which are the following:

Less Air Required

1—The volume of air required for complete combustion of alcohol is only about one-third that required by gasoline, and thus much less energy goes away in the exhaust. Moreover, this smaller dilution with air enables a more perfect mixture to be formed with consequent more perfect combustion.

2—The alcohol-air mixture can be safely subjected to pressures of 200 lb. per square inch without spontaneous ignition, whereas the safety limit for gasoline is 80.

3—All mixtures of alcohol and air containing from 4 to 13.6 per cent of alcohol are explosive, whereas the explosive range for gasoline is from 2 to 5 per cent, necessitating much more careful carbureter adjustment.

4—The combustion products of alcohol are smokeless, almost odorless, and do not clog up the cylinders and valves.

Gasoline for Starting

The only serious difficulty encountered would be the starting of the engine in cold weather and this could be provided for by carrying a small auxiliary gasoline tank to be used in starting.

Raw Materials Abundant

The possible raw materials for alcohol production are unlimited, for anything containing starch, cellulose or sugar can be utilized. In the case of starch we are limited at present to established crops, and the cost of the raw material from such substances as potatoes, maize and rice includes raising the crop, harvesting it, transportation to the distillery and the final conversion there to alcohol. As a consequence the cost of the raw material is too great, varying as it does from 12 to 25 cents per gallon of finished alcohol.

With cellulose and sugar we are able to make use of byproducts of other industries where all the above charges are rightly charged to the main industry, and so with the cellulose waste of the lumber industry, finished alcohol can be produced under present conditions at from 13 to 19 cents per gallon, and from the sacchariferous waste of the sugar industry at approximately 15 cents a gallon.

Around the forests, the fields and sawmills of this country there are millions of tons of waste material now allowed to rot or burn, to get rid of what is in many cases considered a nuisance. Various forms of vegetation, which with the aid of the chemist could be rendered valuable sources of fuel supply, are allowed to die, having served no useful purpose during their existence.

Wastes from paper mills, comprising millions of gallons of liquor containing sufficient fermentable matter to be worthy of exploitation, are allowed to pour into the rivers, impairing their beauty and constituting a menace to the fish in them.

Crops of all sorts, corn, maize, oats, barley, potatoes, rice and many others could be increased and exploited to produce alcohol as a fuel, while the sugar industry could furnish thousands of tons of refuse material eminently suitable for its further production.

Lumber Waste a Vast Supply

Of all the above possible sources, the most interesting, owing to the low cost of raw material, is the waste from the lumber industry, particularly that in the form of sawdust or small chips. This material in the vicinity of sawmills or woodworking plants is often an item of loss owing to its production in excess of their own power requirements, its value never rising above 50 cents per ton, even when used as a source of power. The disposal of this superfluous waste from figures gathered by the Forest Products Laboratory at Madison, Wis., costs from 30 to 66 cents per cord of 1800 lb., the total annual loss from this cause amounting to about $6,000,000 annually, in addition to the value of the wood so burned. This represents an annual wastage of approximately 15,000,000 cords of wood and constitutes only about 50 to 60 per cent of the total waste material produced in this form. Thus we see that there is produced annually in the United States waste material amounting in volume to about 30,000,000 cords, or around 27,000,000 tons, which is now burned as the easiest method of getting rid of it.

Wood Alcohol Useless as Fuel

From experiments which have been carefully conducted by various experimenters, a ton of dry sawdust has been found to yield with proper treatment around 20 to 25 gal. of 95 per cent alcohol (ethyl or grain alcohol, not wood alcohol, for this latter is useless for fuel purposes owing to the formation of products of combustion which would wreck the cylinders) and we could have therefore an estimated production from this source alone of around 500,000,000 gal. annually. If we add to this the amount of wood wasted in the form of stumps and branches sufficiently thick to be barked, which on a conservative basis is equal in amount to the sawdust and chips produced, we would get from this "waste" wood a volume of alcohol almost sufficient to supply with fuel even the stupendous number of automobiles at present in use.

Process Now Used

The process now used for the production of ethyl alcohol from wood consists first of all in hydrolyzing the hogged and shredded waste with dilute sulphuric acid at a steam pressure of about 60 lbs. for a short time. This is done in rotary digestors, made of steel boiler plate with an acid proof lining to insure a thorough mixing of the wood and acid. In this operation a portion of the wood is converted into a mixture of sugars, some of which are fermentable. The digested mass is then transferred to a diffusion battery where the sugar and other soluble material is extracted. The acid extract is neutralized with lime or limestone, and a heavy sludge of calcium sulphate is formed, leaving a neutral sacchariferous liquor on standing. The clear solution is drained off and fermented with yeast, and the alcohol produced separated by fractional distillation and rectified in the ordinary way.

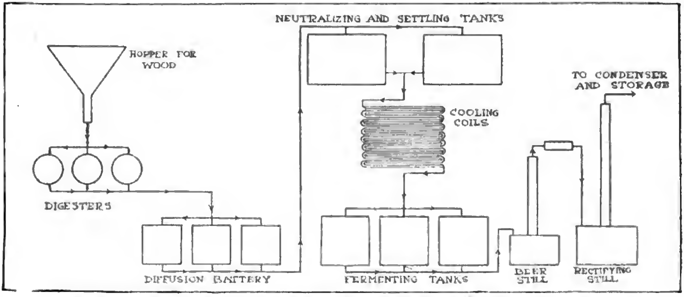
History of Early Work

The first known attempts to produce sugar from vegetable matter were those of Braconnot in 1819, and since that time many have worked, experimental plants have been built and operated, all to meet with failure owing to lack of scientific and engineering knowledge. In 1898 Simonsen published the results of his investigations using very dilute sulphuric acid as the hydrolyzing agent and claimed to have got an amount of alcohol equivalent to 6 per cent of the weight of dry wood used. A small plant was built in Christiania to try out his process but failed owing to the extreme dilution of the acid used, thus making the handling of the large volume of liquor produced uneconomical.

Some time later Classen developed a process in which sulphur dioxide was used as the hydrolyzing agent. This process is interesting for it marked the beginning of the development of this industry in America, for the American rights of the Classen patent were acquired by a Chicago concern in 1903, which, after experimenting, erected a plant at Hattiesburg, Miss., costing about $250,000 to operate on longleaf pine sawdust.

Process Successful if Correctly Used

This plant was a failure for a number of mechanical and technical reasons. Ewen & Tomlinson, who were associated with the Classen enterprise, then struck out on their own and after experimenting with sulphur dioxide in different forms as a hydrolyzing agent, finally abandoned it and went back to dilute sulphuric acid. They erected a plant at Georgetown, S. C., which was later acquired by the DuPont Powder Co. who operated it intermittently until the sawmill in connection with the plant was burned in 1913. While a new mill was being erected they devoted a considerable amount of time and money to research on the problems involved and the result is evidenced by the fact that they are now producing over 2,000,000 gal. per annum of absolute alcohol at a nice profit. Other plants have been built in the west by men without knowledge of the requirements of the process and without adequate technical supervision, and have met their inevitable fate. In fact, as long as the development of this process, which requires the highest type of engineering and chemical skill, is left in the hands of men



Diagrammatic layout of a plant for the manufacture of alcohol suitable for automobile fuel from wood waste of the stock promoting type, the various attempts made will be failures.

Cost of Production

The Forest Products Department, Madison, Wis., has got up as the result of its experiments, an estimate of the cost of production which is given below. The estimate assumes a yield of only 20 gal. of alcohol per ton dry waste, costing 40 cents per cord of 1800 lb. and a location where the supply of waste is uniform and constant for a period of 20 years, with good water facilities and a fairly close supply of sulphuric acid and lime. In such a place, a plant properly designed and constructed, of 2500 to 3000 gal. daily capacity, will yield alcohol of 95 per cent purity at a cost of 13.7 to 19.5 cents per gallon. These figures certainly seem to justify their serious consideration by lumbermen and capitalists, for there certainly seems to be all the necessary factors for successful exploitation here. Some impetus is required though, to get things started and, as stated above, that impetus will surely come when gasoline sticks too long at an inordinately high figure.

The tests and results referred to were for engines designed for the use of gasoline as a fuel, the use of alcohol not having been considered. Were this done, however, and engines capable of taking advantage of the various factors favoring alcohol used, particularly taking into account the greater efficiencies possible, using an engine capable of working at compressions up to 200 lb., it is very likely that after as much time and study had been devoted to perfecting such engines as has been hitherto devoted to those using gasoline, a comparison even more favorable to alcohol might be the result.

Numerous other tests have been performed using mixtures of alcohol with other substances, the most important being benzine. It has been found that such mixtures are superior to either alcohol or benzine used separately, the most effective mixture being that formed by mixing one part of alcohol with one part of benzine. As evidence of this two series of tests may be quoted.

Germans Use Alcohol

In Germany since the war began a considerable shortage of gasoline has developed and substitutes had to be devised. Alcohol is fairly plentiful there, being made from potatoes, while benzine is recovered in a very thorough manner from their by-product coke ovens. It was natural then that they should turn to these for a gasoline substitute. From a series of tests with a Mercedes car of the 1914 touring model having an ordinary carbureter, the following results were obtained.

Fuel	Speed per Hr. (Miles)	Distance Covered on 1 Pint Fuel (Miles)
Gasoline	44	3.60
Benzine	42	3.79
1 pt. benzine 1 pt. alcohol	42	4.66
1 pt. benzine 2 pt. alcohol	41	4.47
1 pt. benzine 3 pt. alcohol	39	4.34
1 pt. benzine 4 pt. alcohol	38	4.10
1 pt. benzine 5 pt. alcohol	36	3.72

Difficulty was encountered in starting the car on the above mixtures and this was overcome by carrying a small auxiliary tank containing gasoline for use in starting. The mixture of alcohol and benzine in equal proportion was found to be decidedly superior to gasoline, and calculated at before-the-war prices, was more economical, too.

W. T. Ormandy ran a series of similar tests on a four-cylinder Maudesty engine (90 by 130 mm. with compression space about 25 per cent of total cylinder volume) and expressed his results as follows:

Fuel Used	Power	Volume of Fuel Used
	Gasoline = 100	Gasoline = 100
Benzine	98.25	84.5
1 benzine 1 methyl sp.	99.0	96.3
1 benzine 2 methyl sp.	92.0	108.9
1 benzine 3 methyl sp.	91.5	124.5

Sp. gr. gasoline 0.710. Sp. gr. meth. sp. 0.815. Benzine used 90 per cent. Sp gr. 0.885. Engine run at 1000 and 2000 r.p.m.

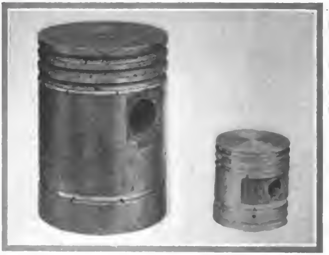
These tests are typical of a number of others and show that mixtures of alcohol and benzine make eminently suitable fuels for even engines built to use gasoline, and that were it possible to produce sufficient benzine the most favorable mixture would be that containing equal amounts of the two.

Possibilities of Benzine

Benzine has long been known as a possible automobile fuel and it is ready to step into the breach as far as possible. The chief factors militating against its use alone are first of all, the unfortunate fact that it solidifies at 5.4 deg. Cent., or 41.7 deg. Fahr. and would thus be useless in cold weather and, secondly, that the maximum possible production at present is about 100,000,000 gal. annually or less than 10 per cent of the amount of gasoline now used. This is not because more could not be produced, for the raw material, coal, is here in abundance, but is due to the fact that only a small percentage of the coal burned annually is burnt in such a way as to allow of the recovery of the benzine from it. If the coal consuming public could be educated to the use of coke for heat and power production, thus allowing of the burning of coal at central stations, as is now being suggested in England, with the recovery of all the by-products, coal gas, benzine, toluene, carbolic acid, naphthaline, creosote anthracene, etc., that now go up in smoke, there could be produced sufficient gas to materially reduce its present price to consumers, benzine enough to use in conjunction with alcohol to replace gasoline and still enough left over, along with the other products, to put the budding American dye industry on a firm independent footing.

Before the war benzine was selling in the neighborhood of 17 cents per gal. and would therefore reduce if anything the price of alcohol with which it were blended. The raw materials for both these, wood and coal, exist here in abundance, both could be obtained as by-products of some other industry, and both at present are produced in insignificant amounts, owing to the lack of initiation and enterprise that are necessary for their production in worth while amounts. If properly developed to their fullest possible extent they would effectively lay the ghost of the failing gasoline supply.

Piston Progress Illustrated



The advance in piston design made in the past five years is brought out strikingly in the two pistons illustrated above. That at the left was used in the six-cylinder Oldsmobile Limited for 1911 and 1912. It was of cast iron and weighed 6 lb., 14 oz. That at the right is the 9 oz. aluminum piston used in the new eight-cylinder Oldsmobile.

Constant Pressure Cycle Truly Efficient

Criticisms of Suggestions Founded Upon Unsound Basis—A Reply to J. L. Napier

By Arthur B. Browne and Herbert Chase

THE criticism written by James Langmuir Napier entitled "The Truth about the Constant Pressure Cycle," which appeared in the August, 1916, issue of *The Automobile Engineer*, and was reprinted in THE AUTOMOBILE, attempts to promulgate so many half truths and contains such wholly unwarranted attacks upon statements made in papers read before the (American) Society of Automobile Engineers and the (British) Institution of Mechanical Engineers, that we cannot permit it to go unchallenged.

Holding up to ridicule what he terms a "quasi-scientific" statement made by Mr. R. M. Neilson,* a former associate of Mr. Dugald Clerk and a member of the Institution of Mechanical Engineers, and charging "neglect of elementary principles" in our paper entitled "Possibilities of the Constant Pressure Cycle," Mr. Napier proceeds to ignore every detail and refinement of the proposed constant pressure cycle save those which, by wholly impracticable comparisons, could be made to subserve his own arguments. He then closes with a diatribe against a "burner" which by actual operation, under conditions more exacting than those of its application to a reciprocating engine, is daily proving the superficiality of his judgment. In order that the truth may prevail we offer the folowing:

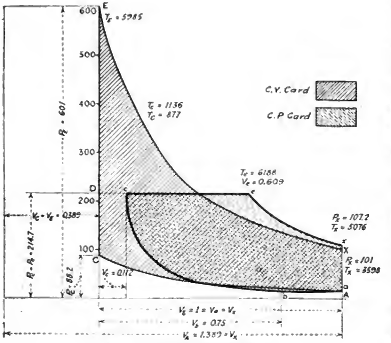


Fig. 1—Two ideal indicator cards

Engines operating upon the constant volume cycle have practical limitations of compression pressure, owing to pre-ignition difficulties and high maximum pressures which do not occur in engines of the proposed constant pressure type.

In the proposed constant pressure cycle the thermal efficiency increases as the load decreases, a most important condition not found in the constant volume cycle.

The proposed cycle renders practicable the utilization of exhaust heat by which means its ideal efficiency is rendered higher than that of any cycle now in use, a fact entirely overlooked by our critic.

The proposed constant pressure cycle is so well adapted to a two stroke cycle that its power output may be made greater for a given bore and stroke than that of the constant volume cycle whether the latter operate on a two or four stroke cycle.

Engines operating upon the proposed cycle are readily adaptable to the use of the heaviest and cheapest liquid fuels which are wholly unavailable in constant volume engines.

The proposed cycle provides means for proportioning the negative work to the work of the cycle. This permits of its use under widely variable loads and enables use of a variable cut-off without throttling.

The proposed cycle also permits of manual modification of two dimensions of the P V diagram. It is thus more flexible than the constant volume cycle.

These conclusions are best proved to practical engineers by comparing the cycles in engines of equal bore and stroke. With petroleum fuels so largely used in modern constant volume oil engines, a compression pressure much is excess of 75 lb. gage is seldom used because of the danger of pre-ignition. Hence an absolute pressure of 6 atmospheres (88.2 lb.) is taken for the purpose of comparison as representing a rather high average. As opposed to this a compression pressure of 200 lb. gage is taken as being a very conservative value for an engine of the constant pressure type, since no serious structural consideration can be advanced against maximum pressures so far below those inherent in the constant volume type. To compare, as does our critic, engines using equal compression pressures is as impracticable as is the comparison of a Diesel engine with one of the constant volume type, using Diesel compression pressures. The constant volume oil engine is necessarily a low compression type while the constant pressure engine is essentially a relatively high compression type.

The two ideal cards shown in Fig. 1 are drawn to scale using strokes of equal length, the compression pressures mentioned above, and starting compression from one quarter stroke in the case of the constant pressure card. That the unloading valve specifically described in our paper provided means for automatically starting the compression at any point of stroke desired, was a point conveniently overlooked by Mr. Napier. The table given herewith shows the varying work areas and efficiencies obtained in other ideal cards with different compression pressures and with compression starting from different points of stroke.

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*The reference cited was taken from a paper entitled "A Scientific Investigation into the Possibilities of the Gas Turbines" which was presented in October, 1904, before the Institution of Mechanical Engineers, of which Mr. Neilson was then an associate member. Among those who discussed Mr. Neilson's paper were Mr. Dugald Clerk, Prof. F. W. Burstall, Mr. James Atkinson, Col. R. E. B Crompton, C.B. These gentlemen would hardly have allowed Mr. Neilson's figures on the constant pressure cycle to go unchallenged if they were not well founded in fact.

From this table it is at once evident that the ideal efficiency of the constant pressure cycle increases rapidly as the load decreases. In the constant volume cycle the *ideal* efficiency remains constant at all loads but in practice it is a well-known fact that the *actual* efficiency decreases very rapidly as the load decreases. At light load the actual efficiency may fall below-one-tenth that at full load.

As to the question of efficiency, the figures given prove conclusively that in this particular the proposed constant pressure cycle under the conditions outlined has a decided advantage over the constant volume cycle when the saving resulting from the perfectly feasible use of a portion of the exhaust heat* is taken into consideration. Entirely practicable means for such utilization were clearly shown in the description and diagram of the proposed engine. Since the saving in heat thus obtainable will render the ideal efficiency from 25 to 80 per cent higher *than it would otherwise be*, how utterly worthless are the conclusions reached by our critic when he deliberately disregards this saving and then uses this faulty premise as a basis for redicule! In fact if substantially the same arguments advanced by our critic had been carried to a logical conclusion he would have proved that the efficiency of the Diesel engine is less than that of the constant volume type of engine, whereas we know from long experience that the reverse is true.

The table and cards given herewith show that the net work areas are somewhat less for the constant pressure than for the constant volume cycle. The difference is however almost nil if a somewhat higher compression pressure be taken than that assumed in the constant pressure card shown. This higher pressure *cannot be* used in practice in the *constant volume* cycle without involving difficulties (such as pre-ignition and exceedingly high explosion pressures) not encountered in the constant pressure type.

Furthermore the constant pressure engine lends itself readily to a two stroke cycle. Its power output *per stroke* in this type is substantially the same as in the four stroke type. Hence when running two cycle the power output of a constant pressure engine is greater than that of a constant volume engine of equal bore and stroke, whether the constant volume engine run two cycle or four cycle.

It is a well-known fact that the two stroke constant volume or Clerk type of engine has a power output *per stroke* which is little more than half that per stroke in the four stroke type. This is due in part to difficulties in scavenging without loss of fuel. On the other hand, in the two stroke constant pressure type, running as it does with practically zero clearance, the scavenging may be made nearly perfect, and this without any loss of fuel, since the latter is not added until the beginning of the working stroke. On this basis our contentions that the power per unit of weight of a constant pressure engine may be made greater than that of a constant volume engine of equal bore and stroke, and that for this and other reasons the engine is better suited for automobile propulsion

(*Continued on page* 948)

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*Mr. Neilson, in obtaining the figure of 84 per cent ideal efficiency quoted in our paper, contemplated saving a large proportion of the heat in the exhaust gases.

Table I—Comparative Data for Two Automobile-Engine Cycles

Item No.	CONSTANT-VOLUME CYCLE		PROPOSED CONSTANT-PRESSURE CYCLE							
	Symbol	Num. Value	Symbol	NUMERICAL VALUE						
1	P'_a	14.7	P_b	14.7	14.7	14 7	14.7	14 7	14 7	14.7
2	V'_s	1	$V_s = V_a = V_x$	1	1	1	1	1	1	1
3	$V'_a = V'_x$	1.389	V_b	0 96	1	0.75	0 50	0 25	1	1
4	P'_c	88 2	$P_c = P_e$	164 7	214 7	214 7	214 7	214 7	264.7	314 7
5	T'_a	522	T_b	522	522	522	522	522	522	522
6	$V'_c = V'_e$	0.389	V_c	0.173	0 1490	0 1118	0 0745	0 0373	0 128	0 1136
7	R	0.0391	R	0.02703	0.02816	0 02112	0.01408	0.00704	0.02816	0 02816
8	T'_c	677	T_c	1052	1136	1136	1136	1136	1207	1269
9	H	91	h	67 5	91 2	68 4	45 6	22 8	91 2	91 2
10	M'_a	0.1056	M_b	0.073	0.076	0.057	0 038	0 019	0 076	0 076
11	T'_e	5985	T_e	6102	6188	6188	6188	6188	6260	6322
12	P'_e	601	P_e (see P_c)	.....	.....	.....	.....	.....	.....	.....
13	V'_e (see V'_c)	.....	V_e	1	0 81	0 609	0.406	0 203	0 666	0.566
14	P'_x	101	P_x	164.7	160	107 2	61	23	149 8	141 7
15	T'_x	3598	T_x	6092	5676	5076	4316	3271	5320	5034
16	W'_g	233	W_g	164.7	209	189 6	152 6	95	242	269
17	W'_c	35	W_c	65.1	75 2	60 2	44 9	29 9	81.8	87.7
18	W'_n	198	W_n	99 6	133 8	129 6	107 7	65 1	160 2	181 3
19	....	.....	h_x	43 7	41	26 7	14 4	4.8	37	33 9
20	E	0.399	e	0 421	0 494	0 575	0 638	0 669	0 550	0 586
21	M.E.P.	198	m.e.p.	99 6	133.8	129 6	107.7	65 1	160.2	181.3

EXPLANATION OF SYMBOLS USED IN TABLE I

The results given in this table are purely theoretical and apply only to ideal cards. The C. P. cycle figures given in Fig. 1 refer, as will be readily seen, to the calculations made for the third column of figures shown under the heading "Proposed Constant Pressure Cycle." All pressures in the table are given in pounds absolute and the temperatures in absolute degrees Fahrenheit. The comparison between the two cycles is for engines of equal displacement with a stroke of 1 ft. and a piston area of 144 sq. in. Exhaust is assumed to take place at the end of the stroke. Certain assumptions have been made in calculating these results. These are explained in the following paragraphs, the figures given at the left referring to the corresponding number under the heading "Item No." in Table I.

1. Both the pressures are assumed; P'_a is the initial pressure for the C. V. cycle and P_b is the pressure at the start of compression for the C. P. cycle.

2. Stroke volume is assumed as unity for both cycles. It will be noted that in the C. P. cycle this volume (V_s) includes V_e, the volume of the point where delivery to the receiver begins, there being no clearance in the cylinder.

3. The volume V'_a is the total cylinder volume and equals also the exhaust volume for the C. V. cycle.

4. Compression and expansion are assumed to be adiabatic. In the C. P. card the unloading valve remains open from *a* to *b*, so that the compression (above atmosphere) starts at *b*. Also $P_c = P_e$ are the pressures at the end of compression and at cut-off respectively.

6. For the C. V. cycle V'_c is the volume at both the end of compression and the start of expansion. For the latter $V'_c = V'_e = V'_s \div [1 — (P'_a \div P'_c)]^{0.71} — V_s$. The volume at the end of compression (V_c) equals $V_b (P_b \div P_c)^{0.71}$.

7. The constant R for the C. V. cycle is $P'_a V'_a \div T'_a$. For the C. P. cycle $R = P_b V_b \div T_b$.

8. T'_c and T_c are the temperatures resulting from adiabatic compression. $T'_c = P'_c V'_c \div R$ and $T_c = P_c V_c \div R$.

9. Heat added in C. V. cycle is assumed to be that resulting from complete combustion of a quantity of fuel having a weight equal to one-fifteenth the weight of air present. Calorific value of fuel is assumed to be 18,000 B.t.u. per lb. In the proposed C. P. cycle a portion of the heat added is recovered from the exhaust gases. (See note 18.) H and h are expressed in British thermal units. $H = 18{,}000$ wt. area $\div 15$ and $h = 1200 M_b$.

10. Weight of gas heated in C. V. cycle includes products of combustion remaining in clearance space, the specific weight of which is *assumed* for convenience to equal the specific weight of air, approx. 0.076 lb. per cu. ft. at 60 deg. F. and 14.7 lb. abs. pressure. In the C. P. cycle gas heated is all air in a cylinder with zero clearance-volume. The volume of gas heated is controlled at will by varying point of cut-off. M'_a and M_b are the pounds of gas and air respectively heated. $M'_a = 0.076\ V'_a$. $M_b = 0.076\ V_b$.

11. For convenience in figuring, T'_e, T_e and h_x (see note 19) are determined on the *assumptions* (a) that the specific heat of the products of combustion is the same as the specific heat of air, and (b) that the specific heat remains constant throughout the temperature range. The specific heat of air at constant volume is taken as $K_v = 0.1689$ and at constant pressure $K_p = 0.2375$. The temperature of expansion (T'_e) equals $T'_c + (H \div M'_a K_v)$. The temperature of cut-off (T_e) equals $T_c + (h \div M_b K_p)$.

12. While P'_e is high in the ideal card, its actual value in practice is known to be much lower than 600 lb. P_e, the maximum pressure attained in the C. P. card, can be controlled at will by simply varying the pressure on the unloading-valve spring. The explosion pressure is $P'_e = R\ T'_e \div V'_e$.

13. The volume at cut-off (V_e) in the C. P. cycle equals $T_e R \div P_e$.

14. P'_e and P_e will both be much lower in practice than the theoretical value noted. The pressure of exhaust in the C. V. cycle (P'_x) equals $P'_e\ (V'_e \div V'_x)^{1.4}$. For the constant pressure cycle $P_x = P_e\ (V_e \div V_x)^{1.4}$.

15. The theoretical values of T'_e and T'_x (as well as T'_c and T_c) are also much higher than in practical engines. The temperatures of exhaust for C. V. and C. P. cycles are respectively $P'_x V'_x \div R$ and $P_x V_x \div R$.

16. The gross area is the total area under upper lines of respective cards. The gross area of the C. V. cycle is $2.5\ (P'_e V'_e — P'_x V'_x)$. For the C. P. cycle it is $P_e\ V_e + 2.5\ (P_e V_e — P_x V_x)$.

17. Negative work is the work of compression in C. V. card and work of compression and delivery in C. P. card. The negative area for the C. V. cycle is $2.5\ (P'_c V'_c — P'_a V'_a)$ and for the C. P. cycle is $P_c\ V_c + 2.5\ (P_c V_c — P_b V_b) + P_b\ (V_a — V_b)$.

18. In the third C. P. card the net work is close to its maximum value when $V_b = 0.75$, hence little is gained, with 214.7 lb. compression pressure, by starting to compress earlier and by cutting-off later. The net work area for the C. V. cycle is $W'_g — W'_c$ and for the C. P. cycle $W_g — W_c$.

19. Piston area = 144 sq. in. One B.t.u. = 778 ft. lb. h_x is determined by assuming that the exhaust gases will heat the air supplied to a temperature midway between T_c and T_x. The heat recovered from the exhaust (h_x) in the C. P. card equals $0.5\ (T_x — T_c)\ M_b K_p$.

20. Thermal efficiency is the ratio of net work done to *net* heat added by fuel. The C. V. thermal efficiency is $144\ W'_n \div 778 H$. For the C. P. cycle e equals $144\ W_n \div 778\ (h — h_x)$.

21. The mean effective pressures equal $W'_n \div V'_s$ for the C. V. cycle and $W_n \div V_s$ for the C. P. cycle.

The Automobile and Truck Industry In Switzerland

War Has Exerted Marked Effect on the Country—Occupations of People Greatly Changed—Many Plants Have Turned to Motor Vehicle Construction—Sales Opportunities

By E. A. Langdon

ALTHOUGH not involved in the world war, Switzerland, like many other neutral countries in Europe, has been doubly busy since August, 1914. The effects of the war are very clearly visible on life in Switzerland, which is surrounded on all sides by belligerents; and, while officially this Helvetian republic is identically in the same situation as during the first six months of 1914, as a matter of fact the past two and one-half years have witnessed striking changes in the life, occupation and methods of work and business of the people of Switzerland.

To begin: There has been considerable change in the occupation of the people. Before the war a great division of the nation was kept busy attending to the many tourists who visited the country. These people were reduced to idleness almost immediately by the outbreak of the war. Then there were a great many industries, such as lace making, which from the first day of the war on found it difficult both to dispose of the products and to obtain new raw materials for carrying on the work. Thus, thousands of people were forced to look for a different mode of occupation.

Practically No Car Imports

As for importing automobiles into Switzerland, this trade is at present practically nil, because there are sufficient facilities for making all the machines the country requires. Moreover, any merchant wishing to import automobiles would find this a very difficult matter, and practically impossible, for he would be required to furnish a more than ironbound guarantee that the vehicle would in no way be made serviceable, directly or indirectly, to the Central Powers. This is, at the present involved state of Swiss industries, almost an impossibility, because the bulk of Swiss industries are occupied with war contracts of some kind or other, and, all denials to the contrary notwithstanding, the relations between manufacturers supplying the Allies and those working for the Teutons are extremely amicable; hence, the country being anything but divided along lines of the two sides in the war, it would be very difficult to promise that a machine would never be used by someone tied up with the opposite belligerent.

However, while, as just stated, there is practically no importation of automobiles into Switzerland, it is safe to prophesy a considerable trade of this nature for the postbellum period. The reasons are:

Modernization Going On

Switzerland is being modernized by the war more than it was during the twenty-five years preceding it; industry will be much enhanced; modern ideas will enter the minds of the people, who up to a short time ago were still, in some ways at least, rather conservative. Such a development cannot help creating an increased demand for automobiles. The machines required will have to be well adapted to the peculiar local conditions of this alpine country; the cars will have to be built with low center of gravity, good hill-climbing ability, and a view to the greatest possible fuel economy; they will have to be medium-priced, light, and strong; they will have to be covered by a reliable maker's guarantee; the purchaser will require the presence, within a few hundred miles, of a supply station of reserve parts; the machines will be expected to have complete equipment; they will be easier to sell if they are fitted with large-size tires; they will, considering the standard of quality, have to compare well with French and German makes, which are well known in Switzerland, and which, even if a little dearer, will be given preference in many instances—other things being equal; in short, American automobile makers working for Swiss business will have to win the confidence of the shrewd population of that country.

A Cosmopolitan Center

It would seem, perhaps, that the results of such endeavors could never be proportionate to the efforts, because of the small size and population of the country. This is, however, a very narrow view to take of the situation. In normal times Switzerland is a meeting ground of all Europe, at least at certain times of the year; and an automobile displayed and doing good work in Switzerland serves to advertise one's products to Danes, Poles, Russians, and inhabitants of the Balkan territories. There is nothing which counts as much in European eyes as "the proof of the pudding," and the work of a machine which stands up well under the strenuous requirements of Swiss touring is bound to impress a prospective buyer of automobiles.

In one respect Swiss business is much easier than in other continental countries. Due to the intense contact with foreigners, the number of Swiss who have a command of English is surprisingly large, and it is hardly necessary for a salesman to speak the native language of the particular section of Switzerland he visits.

A Good Light Car Market

It is also possible that after the war there may be a pretty good market for light automobiles, specially suitable for doing occasional dairy work, which can be jacked up and connected to a separator or such implements. As to plowing machines, hoes, etc., the industries requiring such machines are so small that it would hardly pay to carry on a sales campaign for the introduction of such machinery.

All in all, there is no doubt that Switzerland, too, will be a much more important market after the war than before.

The Call for Cars

Speaking of the call for automobiles: The demand from belligerent countries requires no further elucidation. All belligerent nations are anxious to get into their possession as much automobile equipment as possible. Money is no object. The requirements in Switzerland are also created directly by the war. The first circumstance calling for automobiles is that the supply of freight cars on Swiss railroads is none too ample to transfer the much-increased output of the nation's industries. Motor trucks are needed. Furthermore, there is also an increase of passenger traffic, and while it is almost impossible to obtain statistics at present, when the figures will once be given out they will in all likelihood exceed the foreigners' traffic of peace times. Everyone knows what these remarks refer to. Switzerland has not only become, during these months of war, a highly industrial and efficient manufacturing country, but it has rendered splendid service as an enormous hospital for wounded prisoners who are either sent there to stay or pass through the country to be exchanged as invalids. These men number by the myriads, and naturally require very large transportation facilities.

Troop Transport Requirements

But there is another circumstance which adds to the demand for automobiles. While at peace, Switzerland is at present really on a war footing; many thousands of citizens are continually on border duty. This service includes a very large number of military posts on the alpine peaks on every side of the country, and as the men on duty are there only for short periods the transport of these troops, as well as the supply of food, necessitates the use of numerous motor vehicles.

Thus, in spite of the paralyzing of some industries, the whole population of Switzerland is kept busy, and the automobile is not the least factor responsible for this agreeable state of affairs.

Mention has been made of the difficulty of obtaining raw materials, because each belligerent supplies Switzerland with some materials, but insists that this must be used in no way advantageous to the enemy.

The Allies make the supply of cotton, rubber, etc., dependent on this condition.

The Central Powers take much the same stand with regard to the coal, steel, and oil they supply to the Swiss.

Vehicles of the Truck Type

Time and again the Federal Government has received notes on this subject from both sides; but it would seem—and this opinion has been voiced unofficially by a number of people who are in well-informed places and with whom the writer had interviews—that these notes are sent out by the belligerent governments with the chief intention toward home consumption, while every government in Europe is very glad that Switzerland is neutral and in all probability will remain so until the end of the war.

The machines, as already indicated, are principally built along truck lines, even where they are used for transportation of wounded or invalid prisoners, and where motor vehicles of this type are used they are, as a rule, built on the sightseeing style, which allows for a great number of passengers on one machine. However, there are also special bodies, such as large ambulance wagons, permitting the transport of eight, ten, or twelve men on stretchers. All these trucks are covered and equipped with doors or gatework.

Many Passenger Cars

In spite of the large number of trucks, however, there are a great many passenger vehicles proper being built and used. These machines vary in design and construction, depending on the purpose for which they are destined. Automobiles constructed for field work are as a rule constructed as lightly as is possible for the work they will have to do, and are distinguished by simplicity of design and ample ground clearance, seeing that they will have to do a great deal of work on very poor roadways.

It is a different matter with Swiss trucks. They are built along lines somewhat similar to those existing before the war and are heavy and solid in construction. The reason may be that Swiss engineers have not as yet been benefited by and drawn conclusions from the frontal experiences; but one of the reasons, no doubt, is that the powers purchasing these trucks realize the careful selection of material and labor used in constructing these trucks and order them with a view to specially hard work, such as transporting heavy ordnance, etc. Among the factories specially well adapted for such manufacture are a number of locomotive plants of international repute, although in their case it is not a matter of a factory having changed its complete character, for, of course, there is still a great market for railroad engines in all countries surrounding Switzerland. It would seem, however, that the making of automobiles, especially at the present, is more profitable, offering a fine incentive to all such plants which possess modern machine tool equipment.

Little Munitions Produced

One reason why automobile making has become such a big industry in Switzerland since the beginning of the war is the fact that the Swiss turn out very little munitions, properly speaking. Certain industries, such as watchmaking, which has lost a good deal of its export trade on account of the rise in transportation rates throughout the world, has taken up the making of munition accessories and parts, but none of these is assembled in Switzerland itself; they are sent to the countries of the Entente or Dual Alliance, as the case may be, where they are put together, or fitted together with products of the countries which purchase them. Therefore, the practice of fitting up any old blacksmith shop as a munition factory, as has been done in some countries, does not hold good in Switzerland.

Difficulty in Securing Materials

As mentioned above, there is always a certain difficulty about getting the materials for making automobiles, although this holds true of all kinds of materials, whether they are produced in Switzerland or imported from outside. Hence, the prices of automobiles are very much higher than before the war and seem to be continually on the rise; and, to make matters worse, the sources of materials imported by the Swiss for the purpose of manufacture and export are continually being restricted so as to raise the price of the articles sold to the enemy of the country which happens to sell to Switzerland. The prices of tires and of gasoline are in no way behind those of automobiles, and, if possible, rise more rapidly.

People Want Peace

These facts explain that, while every man in Switzerland is employed and making splendid money, compared with the ante-bellum days, there is not one in the republic who does not hope for the earliest possible close of the war. The Swiss seem to have their doubts as to whether their war-born prosperity will survive the war; but even so, they consider that the general expense of living among a crowd of fighting peoples is far in excess of the benefits. When you ask a Swiss business man for figures he shrugs his shoulders and tells you how many hundred per cent. the national debt per head has increased during the war, due to the need of preparedness all along the border.

Roads Greatly Improved

One of the blessings of the war is a general improvement of Swiss roads. There are now much more motorable roads than before the war. Not that Switzerland was poor in good roads before the war; but there were not enough in proportion to the attractions that country offers to motoring tourists. Furthermore, there were before the war a great number of roads shut to automobile traffic. The war has, in this respect as in so many others, been a great educator to the people in dispelling some old-fashioned prejudices; and in all likeli-

(Continued on page 944)

The FORVM

Horsepower Curves for Tractors

By B. W. Moses

THE necessity for an accurate and simple rating for tractors is a subject that is attracting considerable attention at present. When the term 20 hp. is used it may mean almost anything, one manufacturer takes it to mean the actual power at the draw bar, another to mean the number of horses the tractor will actually displace, another the brake horsepower of the motor, while another may even take the A. L. A. M. rating.

In the computation of power the two quantities that must be measured each time are the pull at the draw bar and the speed of the tractor (not of the engine). These two quantities can easily be obtained, the first by some kind of spring scale and the latter by the expedient of laying off distance stakes.

Knowing then that mechanical horsepower is the result obtained by dividing the product of pull in pounds and the distance traveled in feet per second by 550 it is very easy to obtain:

Hp. = 2.666 × pull in thousands of pounds × M.P.H.

And as an approximate rule it might be taken that the horsepower is equal to five times the pull in tons, times the speed in miles per hour.

In the accompanying diagram the draw bar pull in thousands of pounds is laid off horizontally and the mechanical horsepower is laid off vertically, while the radial lines are speed lines. To obtain the horsepower follow the line vertically that corresponds to the draw bar pull until it intersects the proper speed line, then the horsepower is on the horizontal line passing through that point. For example: What is the horsepower of a tractor pulling 5000 lb. and traveling at the rate of 3 m.p.h.? Answer: 40. Follow the lines *A*—*B*.

On the extreme left of the chart the equivalent horse pull is laid off. This horse pull is based on an animal that will exert a pull of 185 lb. while traveling at the rate of 2¼ m.p.h., and is equal to 1.08 mechanical horsepower. If for example it is desired to know what the equivalent horse pull for the above case is, simply extend the line *B* to the left, obtaining a little over 36 horses.

Another feature of the diagram is that of converting feet per hour to miles per hour or vice versa. On the extreme right the speed is laid off in thousands of feet per hour. And through the center of the diagram running vertically is a heavy line. This line might be called the speed line. The speed in feet per hour can be converted into miles per hour by simply finding the radial line passing through the point of intersection of the line expressing the thousands of feet per hour and the speed line. If in the above example the speed had been given as 15,840 ft. per hour instead of 3 m.p.h., the line *C* converts the distance into miles per hour and the problem is the same as before.

The diagram can be used for any power machine at any speed. If however the speed or the power is too great to be found on the diagram, it should be divided by some factor that will bring it down onto the chart and the result is to be multiplied back by the same factor, thus giving the correct power or speed required.

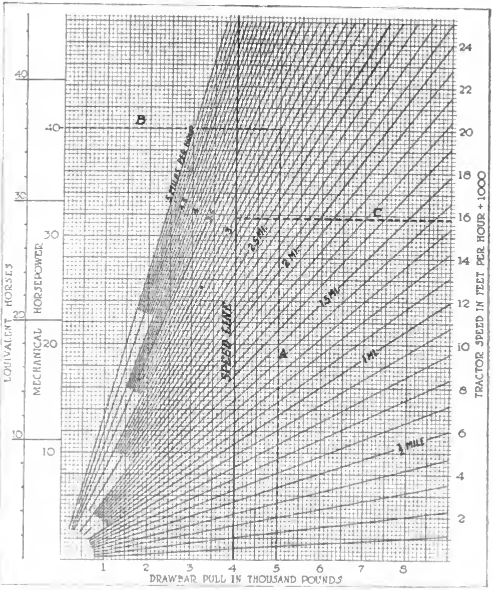
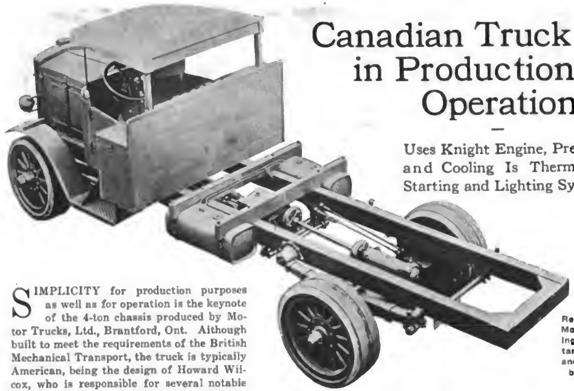


Diagram showing relation between horsepower and speed of motor tractors

Canadian Truck Simple in Production and Operation

Uses Knight Engine, Pressure Oiling and Cooling Is Thermo-Syphon—Starting and Lighting System Fitted



Rear of chassis built by Motor Trucks, Ltd., showing the two 20-gal. fuel tanks, overhead worm and strong frame members. Note roomy cab

SIMPLICITY for production purposes as well as for operation is the keynote of the 4-ton chassis produced by Motor Trucks, Ltd., Brantford, Ont. Although built to meet the requirements of the British Mechanical Transport, the truck is typically American, being the design of Howard Wilcox, who is responsible for several notable constructions now in production in U. S. A.

A Knight four-cylinder 4 by 6-in. engine is a feature of the design, which is a worm-drive construction with a 159-in. wheelbase and a gear ratio in high of 8¾ to 1. Tires are 36 by 5, dual in the rear.

Fundamentally the chassis is simple. It is also silent and embodies a high degree of flexibility. In the frame—the very backbone of the truck—there is primarily simplicity, since there are no rigid cross-members save at the extreme rear end, where there is one large one to carry large gussets to maintain the rectangularity of the frame. It is cold pressed of ¼-in. stock, 7 in. deep, with 4-in. flanges.

This simplicity makes for ease and economy of assembly, it makes for accessibility to the parts and it makes repairs less difficult. By this simplicity the third characteristic of the design—flexibility—is secured, for with all of the cross-members, and only a few at that, of the tubular type, the frame becomes a true De Dion form, which, continuing the chain of cause and effect, permits the use of very flat springs.

These flat springs are accountable to a large measure, according to Mr. Wilcox, for the success of the Hotchkiss drive.

The greatest contribution to silence, as well as the most distinctive feature of the truck, is the Knight engine which is of the same type as adopted by the Fifth Avenue Coach Co. for its new buses, and built by the Moline Motor Car Co., Moline, Ill. It has four cylinders, 4 by 6, giving a formula rating of 25.6 hp., but having shown 65 hp. at 1800 r.p.m. on the block.

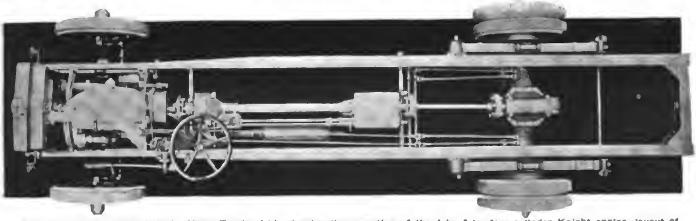
Cylinders are cast in block, together with the inlet manifold, which is completely water-jacketed. The sleeves are so placed in the cylinder that their upper ends are incased by waterjackets on both sides, and they are operated by eccentrics in the usual manner.

Pressure lubrication is secured from a gear-pump, forcing the oil through the drilled crankshaft to main and connecting-rod bearings at pressures up to 50 lb. per sq. in., which vary with the speed, thus providing automatic gradation of the oiling. There is no splash, but the spray from the cranks serves to lubricate the eccentric shaft and the wristpins. The wristpins are hollow and serve to convey the oil to the sleeves, which are oil-grooved and drilled and which in turn work the oil thoroughly between themselves and the cylinders.

Thermo-syphon water circulation is used and by dint of exceedingly liberal water spaces in the cylinder block as well as unusual radiator capacity, a somewhat sluggish circulation is made to have a cooling effect equal to a more rapid forced system through smaller passages. The radiator has unusual height, so that an excellent head of water is secured. Besides this, the top tank extends some distance above the top water header, so that an increased head is provided. The lower headers are two in number, one conducting the cool water to the front of and the other to the back of the cylinder block.

The radiator casing is entirely cast, comprising four pieces, the large top tank, a smaller bottom tank and two side plates.

A complete truck climbing a difficult grade. Note the high radiator and hood, the searchlight mounted on the dash and the substantial bumper bar



Plan view of the chassis built by Motor Trucks, Ltd., showing the mounting of the 4 by 6-in. four-cylinder Knight engine, layout of transmission system and overhead worm drive. Note mounting of electric units, amidship gearbox, etc. Springs are very flat, and this renders the use of Hotchkiss drive a logical feature

The cooling system has the unusual capacity of 17½ gal., most of which is in the radiator. The core of the radiator is of helically-finned copper tubes, individually demountable and sealed by cork gaskets without solder. The top and bottom plates are of copper or brass plate.

A high-tension single magneto with fixed spark cares for ignition automatically. The auxiliary electrical system consists of a Wagner starting and lighting outfit, with the generator and motor separate. The generator is driven from the same shaft which drives the magneto, this shaft being driven from within the timing gearcase by the same silent chain which drives the eccentric shaft gear from the camshaft. It also drives the V-belt for the 20-in. three-bladed cast aluminum propeller-type fan.

The starting motor, which drives the flywheel through teeth milled on it, was selected by testing for a motor powerful enough to start the Knight engine after being in cold storage at a temperature below zero for 24 hr.

The carbureter is a Zenith, which harmonizes very well with the rest of the chassis, since it has no adjustments, valves or springs. Incorporated with the carbureter is the Monarch gas-velocity governor, which operates without outside mechanical connections of any kind. The adjustment of this governor is easily made and is locked with a padlock, so that the driver cannot change it. In its setting, established precedent has been set aside, since it permits the motor a speed of 1800 r.p.m. It is said that the truck may safely be driven for a distance not to exceed 10 miles at 30 m.p.h., and for an indefinite time at 25 m.p.h.

The carbureter is fed by pressure from two tanks, mounted in an original manner. These tanks are 12 by 14 in., of bolster shape, each made of two seamless drawn steel shells, telescoped and welded. Each holds 20 gal., and they are suspended by steel straps from two yoke-like wood beams laid across the frame, so that the tanks lie just outside the frame side-members back of the cab. Pressure is automatically maintained by an air-cooled two-stroke air pump driven by the engine.

Gearbox Is Amidships

Unit power plant construction is not used, since on long wheelbases it is desirable to divide the shaft into two lengths to avoid whipping. This can be done with the best distribution of weight by placing the gearbox amidships. This also permits of greater accessibility and also allows the unit transmission embodied in this design to be employed. The engine is therefore independently mounted on three points, direct from the main frame.

Between it and the transmission unit is a fabric disk universal. The transmission unit comprises the clutch, gearbox, control unit, intermediate driveshaft and brake rocker-shafts assembled into a rigid unit, independent of the rest of the power and driving system. It is suspended on three spherical joints, one at the front, on a tubular cross-member and two at the rear, on the side members. At the front is the clutch housing.

The clutch is a Brown-Lipe dry-disk type, designed to run without oil and of such proportions as to be uninjurable through slipping. It connects with the Brown-Lipe gearbox by a long tube, inclosing the driveshaft.

The gearbox is square with a light removable cover on top. It affords four speeds and one reverse. The gears and shafts are nickel steel, heat-treated and the gears are of 5-7 pitch with 1¼-, 1½- and 1⅝-in. faces. An interlocking arrangement is provided to prevent engagement of more than one pair at a time.

A Rigid Assembly

Back of the gearbox is a tubular cross-member, rigidly attached to the back of the gearbox and, paralleling it are two brake rocker-shafts. Just back of the clutch at the front end is the selector or control unit for the gearset. The shifter-rods connect it with the gearset, and, due to the rigid assembly of the whole transmission unit, correct alignment is assured.

To a bracket at the side of the clutch the hand brake lever and the pedal are attached, their pull-rods to the brake rocker-shafts extending back in straight lines. The single pedal is mounted on the clutch throw-out shaft direct and carries a brake pull-rod besides, so that it fulfills the double duty of clutch release and foot brake.

Behind the gearbox the final or secondary drive is taken by a 26-in. solid shaft with two fabric-disk universals, to the worm-driven rear axle. This is essentially a Sheldon type, except that it has some special features of its own. One of these is the M & S worm self-locking differential. A number of trucks have also been built by this concern without any differentials. These axles have cast steel housings, side-by-side internal brakes and are of semi-floating construction.

The springs through which the torsion and propulsion are transmitted are of the banded type, steel bands being shrunk on at their middles in lieu of a center bolt, thus avoiding any weakening hole at this point. They are flat under load and have three reversed leaves on top to resist rebound. These rebound springs are equal to about one-fourth the thickness of the main springs. The front springs are 44 in. long and 3 in. wide and their eyes are bushed for ¾-in. diameter bolts. Rear springs are 56 in. long and 3½ in. wide, bushed for 1¼-in. bolts at their fronts and for 1-in. ones at the rear, or shackled end. Three rebound clips are used on each spring.

The axle clips are of the round type, bent in an arch over the springs without sharp bends, an iron filler block being inserted between them and the tops of the springs. The

(Continued on page 944)

Westinghouse Club of Practical Value

Technical Education of Employees Developed by Special Classes—Athletic Activities and Social Features Provide Ample Recreation

WELFARE work at the plant of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has grown to a high state of efficiency in regard to educational, social and physical benefit to the employees. Organized in 1902, primarily for the educational benefit of the engineering apprentices, the Westinghouse Club has widened its scope so as to include membership not only from the above company, but also from the Westinghouse Air Brake Co., the Westinghouse Machine Co., Pittsburgh Meter Co. and the Union Switch and Signal Co. The membership now includes something like 850, mainly of the younger engineering students. Membership, however, is open to any factory employee, but owing to its having been organized primarily for the benefit of the technically trained students this class has so far predominated in the membership.

When the club was first organized its activities were mainly lectures on technical subjects, and the establishment of a reading room. Subsequently the club expanded and quarters were purchased where reading rooms, billiard and pool parlors and a completely equipped gymnasium were installed.

Membership in the club is recruited from all of the Westinghouse companies in the Pittsburgh district. The club offers an increasing scope of acquaintanceship among men other than those whom the average member meets in his business relations. It is interesting to note that the club membership during the current year includes men from over 160 different colleges and universities.

Committees Handle Activities

The activities of the club throughout the year are taken care of by specially appointed committees covering athletics, entertainment, technical sections, house, lecture, library, music, excursion and smoker.

The club also extends its operations beyond the factories in an endeavor to afford educational and instructive advantages. The work of the excursion committee is the best exemplification of this and is probably the most interesting work of the club to the new members. Excursions are made to the various manufacturing plants in Pittsburgh. These excursions cover a variety of different classes of manufacture and are conducted under the guidance of experts in the various lines. Provision is made for men on night turn to take these trips on Mondays.

Technical Work Important

One of the most important works of the club consists in the organization of regular classes for the systematic study of the theory, design, and application of the Westinghouse apparatus. Organized primarily as an educational institution, the club management has always felt that the opportunities for study and technical lectures and discussions could not be made too great. No other branch of the club work has been so popular, the enrollment in all the technical sections through the year totaling 951, some men taking work in two sections. The object of the sections is to supplement work in the factory classrooms and in the shops. The classroom work during the first part of the graduate students course takes up the construction and manufacture of apparatus, while shop work covers its actual manufacture. It is the intention of the club to have the members of the section prepare the papers or lectures and enter into the discussions and thus learn by actually performing the work. Beginning this year, a time allowance of 25 hr. per each half term toward completion of the apprenticeship course is made for each graduate student who does the work of a technical section to the satisfaction of the leader of the section.

Gymnasium Completely Equipped

For 2 years now, the club has had its present large gymnasium facilities and has thus been able to develop various athletic teams. The gymnasium room is 65 by 140 ft. and is equipped with the latest forms of athletic apparatus. The floor is also laid out for basketball, indoor baseball, three removable handball courts, and a banked running track with sixteen laps to the mile. Outdoor athletic activities are centered in baseball, tennis, and field sports.

The library has become an important part in the club life. Daily newspapers from all sections of the country are on file, so that every club member can keep in touch with the section from which he comes. A complete file of technical magazines is available. Sectional bookcases are added from time to time as the number of books secured increases. The reading room is visited, according to statistics, by more members than any other room in the house.

As a means of furthering acquaintance and good fellowship among its members, the entertainments held during the year are of great importance. This year in order that those in charge of entertainments could give more attention to the dances and special events a Smoker Committee was appointed to arrange for Apprenticeship Nights and Monthly Smokers.

The lectures have proved a feature of the club life due to the wide range of popular subjects. The idea of these lectures is to afford the members and their friends a means of keeping posted on the topics before the public, and to avoid technical subjects.

The technical man's ability along musical lines is demonstrated by the active interest taken in the various musical organizations fostered by the club.

Club Organization

The club is operated by a board of directors, three of whom are appointed by the company and three elected by the members, one each of three appointed by other companies and the president, vice-president and junior past-president who are elected by the members to these respective offices and thereby become ex-officio members of the board.

A paid manager and assistant manager are employed who devote their entire time to the club. It is the hope of the management that some time the company will have a building devoted to all of the welfare interests, including both the workmen in the shop and those in the offices. In the meantime the company is providing a number of different welfare methods, as told in previous paragraphs. One of the most active and beneficial is the Casino Technical Night School operated under the auspices of the company which affords instruction in the evenings for those employed by the company and others as well, at purely nominal rates. This is open to girls as well as boys. A banner attendance in this department has been made this year, something like over 850 students having matriculated.

Educational Activities of the Westinghouse Club

Above—One of the technical sections at work in the drafting room, receiving instruction in the preparation of details of construction of apparatus produced in the Westinghouse plant

Below — Practical instruction supplements the work of the classroom in the technical educational courses of the Westinghouse Club. The illustration shows one of the sections at work in the machine shop where the students can see the working out of the theoretical matter which they have studied

Above—The gymnasium is 65 by 140 ft., and is equipped with the latest forms of athletic apparatus for regular class and exhibition work. The floor is also laid out for basketball, indoor baseball, three removable handball courts, and a banked running track with 16 laps to the mile

Right—One of the technical sections of the club at work in testing out electrical apparatus

The Automobile Industry in Switzerland

(*Continued from page* 938)

hood the automobile restrictions will be completely removed after the end of the war. There will be other progress in this respect, too, unless indications are misleading. Most likely there will be far-reaching license reciprocity with the neighboring countries, especially France and Germany, so that touring in Switzerland will be still easier, and foreign tourists will be attracted in numbers to make up for what the country has lost in this regard during the war. Already there is a good deal of discussion regarding more modern methods of coping with tourist business; plans are being made for construction of garages where before the war automobiles were kept out, and an intense automobile traffic is confidently looked forward to.

This analysis of the automobile situation shows to what an extent it has been necessary for the greater part of the population to find new occupations and for a great deal of manufacturing capital to turn to new fields of endeavor.

Turn to Car Building

To take up the last point, a number of factories whose entire or chief output consisted in embroidery and knitting machines have devoted practically all their attention to the manufacture of automobiles. In this course they have followed the example of one maker in Arbon, who during the past ten years had turned out quite a number of automobiles, especially commercial cars, which were highly successful, not only in Switzerland, but throughout Europe, and even outside the continent. At present this company makes automobiles only and has quite suspended the manufacture of textile machinery.

Smaller Manufacturers Interested

Such an example could not help stimulating kindred efforts on the part of smaller manufacturers, and this accounts for the great increase of automobile making in Switzerland. Needless to say that the call for automobiles, both in Switzerland and especially in belligerent countries, is so great that the automobile industry is very profitable, and that whoever is in possession of suitable machine tools endeavors to produce motor vehicles. There is, however, one important limitation to these endeavors, namely, the difficulty of obtaining raw materials.

Canadian Truck Simple in Design

(*Continued from page* 941)

shrunk-on bands are machined to accurate size to fit grooves in the spring perches, so that they transmit the propulsion instead of the clips.

Wheels are of wood, with square spokes, fourteen on the rear and twelve in front. The same sizes of tires are used front and rear, namely, 36 by 5, single in front and dual behind.

The steering gear, is on the left side. It is attached to the main frame side-member and has a steering column angle of 35 deg.

Great pains have been taken in the finish of this job. The hood is made of 16-gage steel in three sections. The top section is hinged to the dash and the side sections to the frame sills and detachable. The hold-downs are two in number, being forged and connected with the frame sills by springs to keep the hood tight and prevent rattling and at the same time allow for the movement of the radiator on its flexible mounting in response to frame weaving.

Fenders and steps are of 14-gage steel, pressed from one piece and held in place by heavy cast braces riveted to the tops of the fenders. A simple bracket of bent sheet steel supports the running board. The headlights are attached to forks extending horizontally on each side of the radiator.

The cab is constructed entirely of steel and has a seat wide enough for three large men. On each side of the seat is a large tool box and across the back is a wide bulkhead.

Some of the other ratios, speeds and dimensions are:

Gearset Ratios

First	4.84 to 1
Second	2.84 to 1
Third	1.50 to 1
Fourth	direct
Reverse	5.81 to 1

Total Gear Reductions

First	42.35 to 1
Second	24.85 to 1
Third	13.12 to 1
Fourth	8.75 to 1
Reverse	50.84 to 1

Truck Speeds in M.P.H.

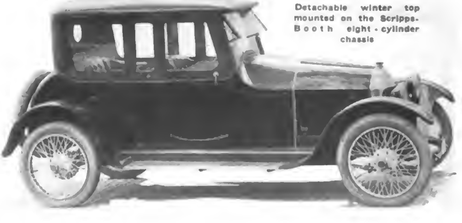
	R.P.M.	
	1,800	1,000
First	4.57	2.54
Second	7.76	4.31
Third	14.68	8.16
Fourth	22.05	12.25
Reverse	3.78	2.10

Dimensions

Loading space back of driver's seat	12 ft. 3 in.
Track, front	60½ in.
Track, rear	67 in.
Chassis overall length	20 ft. 3 in.
Height to top of frame	33 in.
Overall width	7 ft.

Scripps-Booth Detachable Winter Top

THE detachable winter top illustrated at the right on the eight-cylinder Scripps-Booth is designed to appear as an integral part of the car, although it may easily be removed and the regular top mounted. The detachable top fits closely to the body of the car, with flush sides and will not rattle. Windows are removable and the interior is finished in gray whipcord with a dome light. Both the winter top and the regular top are furnished with the eight-cylinder model for $1,350, the price without the winter top being $1,175.

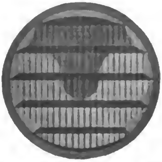


Detachable winter top mounted on the Scripps-Booth eight-cylinder chassis

ACCESSORIES

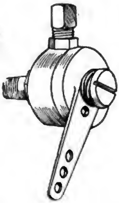
Primolite Headlight Lens

BY a prismatic construction this lens throws the greater part of the light upon the road straight ahead but diffused in such a manner that the driver can see cars coming from the opposite direction and also the road on both sides of the car, so that the danger of passing is eliminated. Light rays run to each side almost at right angles from the face of the lens, so that objects on both sides of the driver are distinguishable at a distance of 50 ft. back from the road. Each lens is divided into a series of vertical divisions, each of which is a convex lens, and as the face of the lens is frosted the convex divisions each throw the rays at diverging angles, these rays crossing and re-crossing those shining through the frosted portion, thus mellowing the light. For 8 to 9-in. headlights the lens sells for $2.90; for 9 to 9⅞ in., $3.50, and for 9⅞ in. up, $4.20.—Primolite Company, 945 Lemcke Annex, Indianapolis, Ind.


Primolite headlight lens which is designed to throw light upon the sides of the roads as well as straight ahead without glare

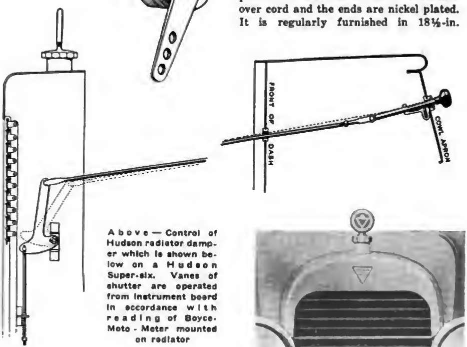
Hydrovaporizer

A mixture of water and air is injected into the intake manifold by this device. Water is drawn from the engine and air from the outside, mixed in the chamber of the device, and carried into the combustion chamber in a fine spray, it is claimed. The proportion of air and water may be controlled from the seat, and it is said that the efficiency of the engine is bettered and carbon prevented. Price, $6.—Accessory Mfg. & Sales Co., 1507 Hennepin Avenue, Minneapolis.

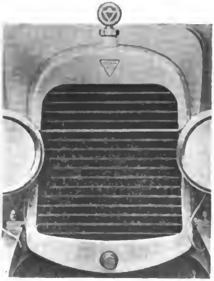

Hydrovaporizer for injecting a mixture of water and air into the intake manifold

Hudson Radiator Damper

By replacing the standard radiator shell of the Hudson Super-six with a special shell housing a shutter mechanism, as shown in the illustrations, the running temperature as indicated by a Boyce Moto-Meter may be controlled from a plunger on the instrument board, the operation consisting in throttling the air passing through the radiator. The vanes of the shutter may be left completely open, as in warm weather; completely shut, as in very cold weather, or at any point between these extremes which the Boyce Moto-Meter indicates as securing the best running temperature. In installing, it is only necessary to change the radiator shell, drill a hole in the instrument board and another in the dash, and then to connect the operating plunger on the instrument board with the bell crank of the shutter by a control rod. No machine work is required in the installation, which may be made in 2 to 3 hr. With the Boyce Moto-Meter, which is a necessary part of the device, the price is $25. If the car is already equipped with a Boyce Moto-Meter the remainder of the equipment sells for $15.—Hudson Motor Car Co., Detroit.

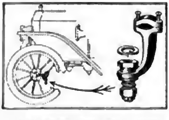


Above — Control of Hudson radiator damper which is shown below on a Hudson Super-six. Vanes of shutter are operated from instrument board in accordance with reading of Boyce-Moto-Meter mounted on radiator



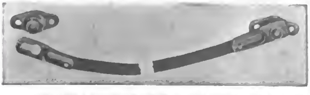
King Anti-Rattler

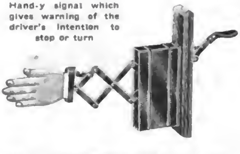
This anti-rattling device is made for attachment to the steering spindle of Ford, Overland and Dodge cars. A hanger is secured to each end of the tie-rod, the lower end rigidly supporting the spindle and carrying a spring that is said to automatically take up wear. It is easily attached by anybody. Price, $1.50 per pair.—King Specialty Mfg. Co., 207 Washington Street, Brookline, Mass.


King spindle joint anti-rattler

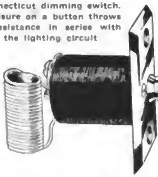
Ideal Robe Rail

The Ideal rail is detachable at one end to facilitate placing coats, robes, etc., in position. The center of the rail is leather over cord and the ends are nickel plated. It is regularly furnished in 18½-in.


Ideal robe rail which is detachable at one end



Hand-y signal which gives warning of the driver's intention to stop or turn



Connecticut dimming switch. Pressure on a button throws a resistance in series with the lighting circuit

Nitrojector spotlight

lengths although other lengths are made to order. There is a special rail 24 in. long for Ford cars. The rails sell for 75 cents.—Ideal Brass Works, Tenth Street and Canal, Indianapolis.

Hand-y Signal

Extending a hand from the side of the car on a lazy tongs device operated by the driver, this device gives warning of an intended stop or turn. The signal consists of a bright-red metal hand fastened to the end of steel folding members that fold into a metal case attached to the side of the car. The hand is swung to the extended or closed position by a lever on the open-car model; on the closed-car model it is operated by a chain. It may be attached to any car in 5 min., it is said. Special emphasis is laid on the simplicity of its installation on closed bodies. For open cars the signal costs $3; for closed cars, $3.50.—Kaenjay Sales Co., 105 Chambers Street, New York.

Nitrojector Spotlight

This searchlight has an adjustable focus mounted on the windshield by means of a swiveled clamp. The rays of the light are controlled by a shutter around the bulb of the lamp and controlled by a thumbscrew placed in the handle of the lamp. The rays may be controlled from a small ribbon having a diameter of 4 ft. at 500 ft. to the general illumination common to all lights, it is claimed. Another advantage claimed is that the lamp is entirely free from glare. Price, $10, complete.—Hawthorne Mfg. Co., Bridgeport, Conn.

La French Spark Plug

These plugs are claimed to enable the car owner to get the same mileage under similar conditions of load, road and distance with a mixture of 60 per cent kerosene and 40 per cent gasoline in the tank as with gasoline only. A feature of the construction is the use of porcelain baked inside the independent steel shell. The porcelain is also protected above the shell by Bakelite. An asbestos packing around the independent steel shell provides for heat expansion and a twin conical porcelain prevents short-circuiting. The construction of the plug is clearly shown in the accompanying illustration. The manufacturer claims that it is never necessary to take this plug apart to clean it, and the spark gap, which is ⅛ in. wide, is unusually accessible besides having the advantage of extending well down into the combustion chamber. Plugs are made in ½ in. and ⅞ in. S. A. E. sizes and sell for $1.—La French Spark Plug Co., 206 Meredith Street, Dayton, Ohio.

National Safety Signal

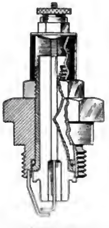
The driver's intentions are manifested by electrically lighted semaphores attached at each side of the windshield. The light carried at the end of the left arm is red, the one at the right green, and either or both may be swung from the vertical to the horizontal position by means of a knob attached to the dash at a point convenient to the driver. As the light drops to the horizontal position it lights automatically, pointing the direction that the driver intends to turn. Price, $15, installed.—National Auto Signal Co., 251 West Seventh Street, St. Paul, Minn.

Connecticut Dimming Switch

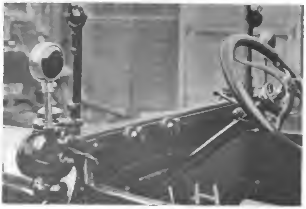
A button switch located at a point convenient to the driver throws a resistance in series with the lighting circuit, causing the lights to grow dim. The resistance consists of a small coil of special wire connected at each end to two binding posts secured in the end of a hollow fiber cylinder. On the interior of this cylinder are two brass brushes, secured at one end to the binding posts, the other ends resting on the switch plunger. The inner end of this plunger is uninsulated and grooved, the balance of the plunger being insulated so that when the plunger is pressed in as far as possible the ends of the two fiber brushes are disconnected and the current forced to pass through the resistance wire. By pulling on the plunger the two brushes come into contact with the metal end, are short-circuited, and the lighting current allowed to pass unrestricted. The installation requires only that a ¾-in. hole be drilled in the dash, the insulating cylinder slipped in place and the plunger plate screwed onto the face of the dash. One wire of the lighting circuit is then cut at any point and each of the two ends attached to its respective binding post on the dimming switch.—Connecticut Telephone & Electric Co., Meriden, Conn.

Steering Gear for Fords

A steering gear installation for Fords. The operating member is a hollow sphere, having a spiral groove cut in its surface. A boss on the yoked shaft bearing the steering arm rides in this groove, and is moved or held by the metal sphere. The gear works on roller bearings, and is said to be exceptionally easy to operate. It is also claimed to be exceptionally easy to operate, and to require but one turn of the wheel to throw the wheels from one extreme to the other.—Price, $12.50.—Nash Mfg. Co., 1723 O Street, Lincoln, Neb.



La French spark plug



National Safety semaphore signal mounted on a car

Industrial Miscellany

Factory

Dupont Fabrikoid Co., Toronto, Ont., is erecting new buildings. Estimated cost of buildings is $75,000 and estimated cost of machinery $175,000.

Crown Tire & Rubber Co., Ralston, Neb., is planning a factory to consist of six buildings.

Field Motor Co., Grand Rapids, Mich., has purchased the Brown & Sehier factory in this city for $14,000 and will manufacture a motor under patents owned by E. A. Field.

Auto Specialties Mfg. Co., Joliet, Ill., will build a two-story, 80 by 400 ft., factory on Edgewater Field at a cost of $25,000.

Canton Auto Parts Mfg. Co., Canton, Ohio, recently incorporated with a capital of $300,000, is planning a 50 by 200 ft. plant.

Mayo-Skinner Mfg. Co., Chicago, is now in its new home at 2115 Elston Avenue, Chicago. This company manufactures hand pumps, spark plug pumps, air compressors, electric garage pumps.

Doehler Die-Casting Co., Brooklyn, N. Y., has let a contract for the construction of a steel and concrete addition, 50 by 100, seven stories, and costing about $150,000.

C. A. S. Products Co., Columbus, Ohio, manufacturer of automobile gears, has completed alterations at its plant, which has more than doubled in capacity. The company is employing 130 men.

Sheller Wood Rim Manufacturing Co., Portland, Ind., which is capitalized at $25,000, has been formed. The company will manufacture single-piece wooden automobile steering wheel rims, the patents on which are held by H. E. Sheller. Directors of the company are Mr. Sheller, E. J. Minch, A. F. Blowers, E. M. Haynes and Carl Bimel. Plans are under way for the erection of a new plant for the company.

H. and M. Auto Parts Co., Cambridge City, Ind., has been incorporated with a capitalization of $10,000 to manufacture piston rings and piston heads. The officers are O. E. Huddleston, president; C. J. Marson, vice-president, and C. J. Marson, secretary-treasurer. The company has set no date for beginning operations.

Mitchell Motors Co., Racine, Wis., is building several thousand feet of new sidetracks and loading platforms, the existing system of more than three miles of trackage in and around the plant being inadequate to handle the record-breaking shipments of Mitchell cars. Both the Chicago & Northwestern and Chicago, Milwaukee & St. Paul lines run directly into the big works and provide unusually good facilities for shipping.

Personal

A. J. Miller, president; J. H. Wells, vice-president, and E. P. Humphreys, secretary-treasurer, are the officers of the recently formed Bellefontaine Automobile Co., Bellefontaine, Ohio, to manufacture automobiles.

D. J. Hayden, formerly sales manager of the Marion Motor Car Co., Indianapolis, Ind., is the head of a new company, the Hayden-Steele Co., which will handle the retail sales of Hupmobiles in Indianapolis and Marion County. The new firm has headquarters at 544-546 North Meridian Street. Associated with Mr. Hayden is J. P. R. Steele, secretary of the firm, who for several years has been Southern manager for the D. L. Auld Co., Columbus, jewelry maker.

E. E. Russell has been appointed general purchasing agent of the J. I. Case Threshing Machine Co., Racine, Wis. His appointment takes effect Jan. 1. Mr. Russell has been with the Case Company since 1889. For the past 12 years he has been in charge of foreign sales. Prior to that he had served the company as salesman, collector, branch house manager and assistant sales manager; later was engaged in opening up a number of foreign branches, which led up to the position of manager of foreign sales. He has also been connected with the cost department.

Capt. Oliver Hezzelwood has resigned his position as manager of the Toronto branch of the McLaughlin Motor Car Co., in order to devote all his time to military work. Captain Hezzelwood was president of the Citizens' Recruiting League and is now acting as a special recruiting officer in the Toronto military district. C. M. Ricketts succeeds Mr. Hezzlewood.

The Automobile Calendar

ASSOCIATIONS

Dec. 2-9—Electricians' Country-wide Celebration.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.

Nov. 16—New York City, S. A. E. Meeting.

Nov. 23—Philadelphia, Pa., S. A. E. Meeting.

Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.

Nov. 30—Uniontown, Pa., Speedway Race.

Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship

June 23—Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14——Des Moines, Iowa, Speedway Race, Championship.

July 4—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15—Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race, Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.

Dec. 2-9—Springfield, Mass., Show, Auditorium, H. W. Stacey, Mgr.

Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.

Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R Gates, Mgr.

Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.

Dec. 30-Jan. 6.—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.

Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 7-10—Philadelphia, Show, Philadelphia Automobile Trade Assn.

Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.

Jan. 23-27—Baltimore, Md., Show, Fifth Regiment Armory.

Jan. 27-Feb. 3, 1917—Chicago Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.

Feb. 10-15—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 12-17—Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.

Feb. 12-17—Cedar Rapids, Ia., Show, Cedar Rapids Automobile Trade Assn.

Feb. 18-25—St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.

Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24—Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.

Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.

March 3-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade.

Personal

S. R. Scott has become district sales representative of the Denneen Motor Co., Cleveland, maker of the Denmo trucks. This company has appointed the Butler-Veitch Co., Berkeley, Cal., as its distributor in that territory.

George Price will handle the sales department of the J. A. & W. Bird Co., Boston, covering the entire territory south of New York, as far west as the Mississippi, and also including the states of Louisiana and Texas. He was formerly manager of its New York office.

C. T. Kenworthy has become vice-president and general manager of the Roamer Motor Car Co., Chicago. He was formerly distributer for the Rauch & Lang electric in New York.

T. E. Hanika, an Indianapolis newspaper man, has been appointed manager of the advertising department of the Gibson Co., Indianapolis, Ind., Overland and Willys-Knight distributor in Indiana, and automobile tire and accessory dealers. He succeeds R. T. Farrington, who has gone to San Francisco, Cal., to engage in publicity work.

James Coggeshall has been appointed manager of the wholesale department of the R. E. Taylor Co., New York, distributor for aGrford trucks in this city, New Jersey and New England.

W. P. Pollitzer has become sales manager of the Rock Island Mfg. Co., Rock Island, Ill. He was formerly Chicago branch manager of Edw. V. Hartford, Inc., Jersey City, N. J. The local company manufactures hardware specialties and automobile specialties. Mr. Pollitzer was with the Hartford company for 15 years. He takes up his new duties Dec. 1. Edward Leinbach will succeed Mr. Pollitzer at Chicago.

R. Adamson has been appointed manager of the Birmingham, Ala., branch of the Ford Motor Co. R. C. Ruggles, former chief clerk, has been made assistant manager. G. C. Nicholes, who came to Birmingham from Seattle, has been transferred to Cincinnati as manager of the assembling branch in that city.

A. E. Morrison has joined the staff of the Maxwell Motor Co., Detroit, as special sales representative. Mr. Morrison was formerly branch manager on the Pacific Coast for the Hupp Motor Car Corp.

Dealers

Nova Scotia Velie Co., New Glasgow, N. S., has been formed to handle the Velie car.

Southern Arizona Motor Co., Tucson, Ariz., has been made distributer for the Mitchell.

S. H. Blackburn and Edward Olson have been appointed Arizona agents for the Pullman, with headquarters at 235 West Washington Street, Phoenix.

G. S. Holvey, who has been operating as the Holvey Motor Truck Sales Co. in Rochester, N. Y., will, on Dec. 1, become city sales manager of the Selden Motor Truck Sales Co., Rochester. A local branch will be established in Rochester.

J. B. Crockett Co. has secured the exclusive sales rights for the Branford carburetor in South America, Australia, New Zealand, Tasmania, South Africa, Straits Settlements and Dutch and British India. The Branford carburetor, marketed by the Holt-Welles Co., 1790 Broadway, New York, is designed for Fords and other cars.

Boice Motor Equipment Co., Boston, is now handling the Heinze-Springfield starter for Fords, the Vesta Accumulator Co.'s products. It also represents the K. W. Ignition Co. and the Standard Thermometer Co.

Automobile Supply Co., Tacoma, Wash., has been appointed distributer for Rayfield carburetors for all of western Washington, Kittitas and Yakima counties in eastern Washington.

W. H. Wallingford, Portland, Ore., Ford agent, has moved into larger quarters at 908 Alder Street.

J. E. Tryzelaar, Portland, Ore., has been named distributer for Grus Spring Oiler and opened headquarters at 29 N. Broadway.

Richard Rinne, Tacoma, Wash., has purchased the Commercial Auto Co. He has also taken over the agency for the Velie.

E. M. Lang, Auburn, Wash., has secured the territory in Auburn and adjacent territory for the Maxwell, Oakland and Chalmers.

Kaenjay Sales Co., 105 Chambers Street, New York, which has taken over the exclusive distribution of the Hand-y signal, is composed of L. T. Kauffmann and R. L. Jones, both of whom have had previous connection with the industry. Mr. Kauffmann was sales manager and Mr. Jones factory superintendent of the Nonpareil Horn Mfg. Co., New York.

Van Cortlandt Vehicle Co., New York, has opened salesrooms at Sixty-third Street and Broadway to handle the Peerless cars, formerly handled by C. T. Silver. Walter Woods is manager and J. A. Clark sales manager.

Marathon Tire & Rubber Co., Ltd., St. Catherines, Ont., has appointed the following distributers: Wood Vallance & Leggatt, Ltd., Vancouver, and Wood Vallance, Ltd., Winnipeg and Calgary, distributers for Manitoba, Alberta and Saskatchewan.

Constant Pressure Cycle Truly Efficient

(Continued from page 936)

than constant volume engines, is entirely justified, our critic to the contrary notwithstanding.

Utilization of exhaust heat brings to the proposed cycle another advantage. It enables the use of heavy fuel which without this heat would be difficult to vaporize. At practical temperatures already actually obtained, it has proved possible to make a fixed gas of the heaviest oil and to thoroughly mix it with the proper proportion of air prior to combustion. On this account, if for no other reason, the proposed engine bids fair to fill a long felt want for a prime mover free from the inherent difficulties of the Diesel engine while not dependent on highly volatile fuels for satisfactory operation.

Concerning the question of flexibility it should be noted that it is possible to vary the point of cut-off exactly as in the case of a steam engine. When the point of earliest feasible cut-off is reached, a further modification of the card may be obtained by throttling. Thus both dimensions of the card may be varied by a simple control device, with corresponding accommodation to load. In other words the proposed engine must be exceptionally flexible.

We shall not here attempt a comparison of the constant pressure and constant volume cycles with expansion carried to atmosphere for the reason that no practical constant volume engine utilizing means for expanding to atmosphere has yet been recognized. We have however already shown the utter fallacy of Mr. Napier's deduction as to relative cylinder volumes by proving that the constant pressure engine will develop more power per unit of cylinder volume at full load than the constant volume engine is able to do.

We readily admit that at light loads (where expansion is carried to atmosphere) the constant pressure engine's cylinder volume is relatively great as compared to the work output. But (even though expansion to atmosphere is not practicable in constant volume engines) it is equally true that at light load constant volume engines also have a very large cylinder volume as compared to their power output.

In view of the foregoing it would appear that our critic had jumped to the conclusion that, whereas the old Brayton type of constant pressure engine had proven an unsuccessful competitor to the Otto type, all constant pressure engines suffer the same or similar limitations. In point of fact the proposed constant pressure engine eliminates the shortcomings of the Brayton type while still retaining the latter's numerous inherent advantages. It thus introduces a new type which bids fair to replace in time engines of the Otto, Diesel and semi-Diesel types.

Mr. Napier closes his criticism with the statement: "The burner described and illustrated in considerable detail will not, however, work as an igniting device for a reciprocating engine." We make no claim to this effect. In fact a spark plug with coil or magneto is expected to answer this purpose —as is the case with the constant volume engines. Concerning the functioning of the burner for the purpose intended, the opinion of Mr. Napier is valueless since experiments already concluded have established the practicability of the burner.

Advance in Prices of Velie Cars Effective January 1st

VELIE *Quality must be maintained.* To do this, in the face of the enormous rise in cost of superior materials and workmanship used in Velie cars, it is necessary for us, in common with other manufacturers of the best cars, to advance prices.

Accordingly, an advance of $50 will be made in Velie "Biltwel" Six with open bodies delivered on and after Jan. 1st, 1917. Cars ordered and delivered prior to that date will be at the present prices:

Model 28, five-passenger Touring, $1085; with detachable Sedan Top, $1285; four-passenger Companionable Roadster, $1085; two-passenger Roadster, $1065.

Model 27, seven-passenger Six—the utmost in luxury and refinement, $1550.

The only Velie cars excepted from this advance are the following exclusively designed models:

Cabriolet, $1485; Touring Sedan, $1685; four-passenger Sociable Coupe, $1750; Town Car, $2200.

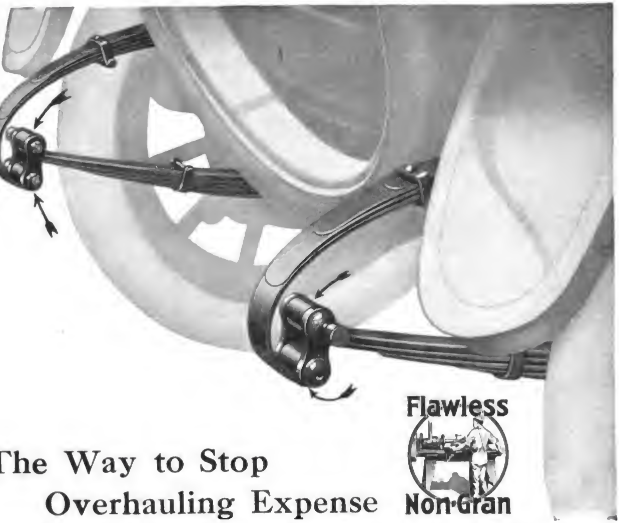
With the powerful Velie Special Continental Motor—Timken Axles front and rear—long, easy-riding Underslung Springs—Multiple Dry Disc Clutch—Remy Automatic Ignition—Vacuum Feed—Push-button Starting—Everything in and on. And the famous Velie Deep-tufted, Genuine Leather and Curled Hair Upholstery. *Better cars are not built at any price.*

Write for Our Proposition

Velie Motors Corporation, 114 Velie Place, Moline, Illinois

Velie Biltwel Six

Bigger—Better—More Power



Flawless

Non-Gran

The Way to Stop Overhauling Expense

Cars rattle to pieces quickly only because the wear-subjected bushings cannot stand the strain.

There are scores of bushings in every car. These bushings determine how much service a car will render before it begins to rattle.

Consider, for instance, one little bushing—the spring eye bushing. With every little bump and every big bump the spring eye bushings oscillate on their shackle bolts. Imagine, if you can, the friction these little bushings must successfully withstand.

Loose play in the spring eye bushings, even though it be slight, is exaggerated a lot by the time it reaches the body and this means *excessive* side sway. With loose spring eye bushings your car will not "hold the road."

Practically all manufacturers of high grade cars and motors, practically every taxicab company east of the Mississippi, practically all licensed racing drivers, as well as practically all well-informed repairmen, use and recommend Non-Gran bushings.

Experience and scientific tests have proven time and time again that Non-Gran, although more expensive to buy than ordinary bearing bronze, considered from the viewpoint of service, is vastly cheaper.

No other part of a car is more subject to wear than the bushings. Why? Because the purpose of a bushing is to take the wear between moving parts. Bushings are the parts that wear out.

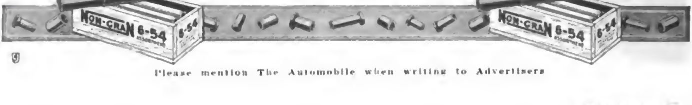
One big reason why high grade cars give years longer service is because their bushings are made of Non-Gran instead of the usual run of bearing bronze.

If you are not the fortunate owner of a car equipped with bushings of Non-Gran, be sure your repairman gives you Non-Gran bushings throughout the next time your car is down.

By so doing you will save hundreds of dollars in future repair bills and your car will be equipped with the same flawless, long-wearing bushings that enable quality built cars to deliver from two to five times the service of cheaper cars.

American Bronze Company
Berwyn . . . Pennsylvania

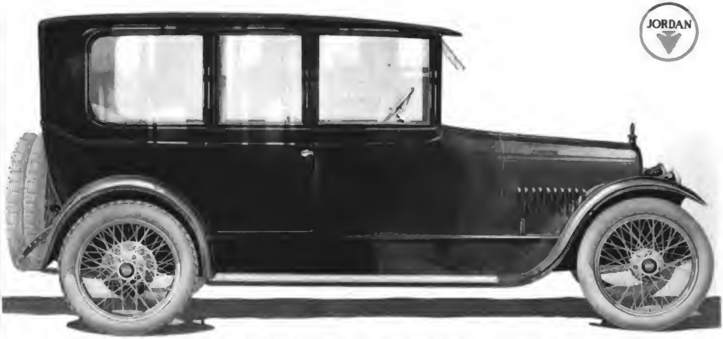
HIGH SPEED
NON-GRAN
BEARING BRONZE



JORDAN

Success

JORDAN



The Jordan Sedan, correct in every line, low, as is the 1917 fashion, finished in exquisite colors and upholstered with a choice of rich domestic fabrics or the most expensive French tapestry

Jordan Success

SUCCESS—instantaneous and complete, has come to the Jordan. The Jordan idea of a high grade standard chassis, with a choice of distinctive custom style bodies, has won nation wide approval.

Thousands of persons of good taste, grown weary of commonplace things, had long been waiting for a distinctive car.

Twenty-six hundred dealers, knowing the keen public demand for distinctive appearance, comfort, service, and performance, made application for the Jordan line.

Hundreds of Jordan cars are now in the hands of happy owners.

Having set the standard of style, price, and quality in the medium price field, Jordan acknowledges the sincere flattery of imitation, and gladly accepts the responsibility of style leadership.

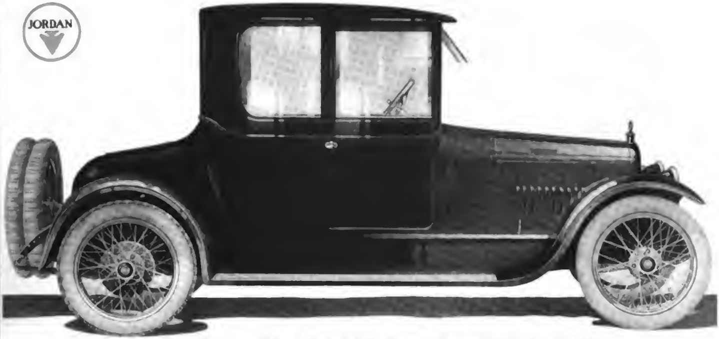
Those producers of other cars, who are advancing prices in a sincere effort to equal Jordan standards in appearance, finish, and appointments, do us honor.

But Jordan aspirations extend beyond mere style leadership.

Jordan inspiration is a quality ideal of which distinctive appearance is the outward expression, to be sure.

But of even greater significance is Jordan performance, expressing collectively the spirit of each individual workman—a spirit which money cannot buy, possible only under conditions created by a limited production and Jordan methods of manufacture and inspection.

Jordan success has demonstrated that the dominant desire of the



The Jordan Four Passenger Coupe, produced in limited numbers, upholstered in domestic fabric or French tapestry. All passengers face forward

experienced buyer is for distinctive appearance, distinctive comfort, distinctive reliability, and distinctive performance.

The individuality of Jordan appearance and the quality of Jordan comfort was immediately established.

Jordan Performance

It remained for dealers and owners, long experienced in the use of the finest cars produced in the world, to establish beyond question, the quality of Jordan performance and service.

Within ninety days the Jordan had taken its place in the front rank of the world's greatest motor cars.

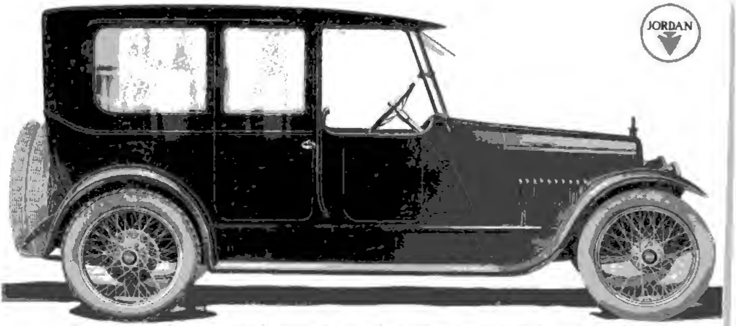
John G. Dale, who sold the Simplex in New York for years, found the critical New York public keen for Jordan style when he gave the car its metropolitan introduction.

He wanted to know how the car performed, so he drove it 500 miles with perfect satisfaction, taking it over the crest of Fort George Hill on high gear at 25 miles per hour.

George R. Bentel, distributor of the Mercer and Jordan on the Pacific Coast, got his first shipment of Jordans by express.

Two cars were to be shipped on the boat from Los Angeles to San Francisco for display in that city. The boat sailing was cancelled and they were sent over the mountains five hundred miles in twenty-two hours on high gear all the way.

California people, the most experienced motor car buyers in America, proclaimed the Jordan a big hit.



The Jordan Limousine is low to the point of distinction, exclusive in style and comfort, upholstered in French tapestry or imported cloth, with seats arranged for a woman's complete comfort

Galbraith Miller, Jr., Milwaukee distributor of the Jordan and Marmon, gave the Jordan the next supreme test.

The first car, upon receipt, was immediately entered in a 500 mile reliability tour. It came through with a perfect score.

Babbitt-Polson, distributors of the Jordan and Buick in Arizona, contracted for their allotment of Jordan cars by telegraph.

They sold the first two to the Fike Stage Line, running between Phoenix and Globe.

The Jordan negotiated the entire distance of 140 miles over the Tombstone Divide, without changing a gear.

Babbitt-Polson say the Jordan has more power on high gear than any car they ever tried out.

Robert McCurdy, for years distributor of the Pierce-Arrow in Pittsburgh, drove his first Jordan car from Pittsburgh to Philadelphia, 302 miles, in nine hours and fifty minutes on high gear.

"I have made the trip twenty-eight times before," said Mr. McCurdy, "but never before made the entire distance on high."

F. A. Hinchcliffe, for fourteen years distributor of the Winton in Boston, took his first Jordan car on a 500 mile test trip around New England. **It startled him with its performance.**

Then came a test in the hands of an individual owner, when E. A. Oviatt sent Joe Denton, his driver, on a transcontinental trip from Akron, Ohio, to Santa Barbara, California, at almost record speed.

The Jordan averaged 25 miles per hour, across desert and mountain, arriving in perfect condition at the winter home of Mr. Oviatt.

E. H. Habersham, Jordan and Reo distributor in Baltimore, took

his first Jordan car from Cleveland to Baltimore, over four mountain ranges, in 16 hours on high gear.

Such performance only confirms the impression of Mr. Jordan, who drove the first model car built, five thousand miles almost without stopping, and going over Uniontown Hill in Pennsylvania, at 35 miles per hour on high gear.

In this way Jordan performance and service have been proved by every dealer, and every owner, who proudly drives this car.

Jordan distinction and quality have been established in a hundred different ways.

The success of the chassis is founded upon its mechanical excellence.

It is light — the lightest on the road for its piston displacement and wheel base, with unusual flexibility of applied power.

It will demonstrate on any road, or any hill, with any stock car made.

The chassis includes all the universally approved mechanical units.

It is economical, with over-sized tires and perfect carburetion.

The wheel base is 127 inches.

If any well-informed, critical individual set out to build a car to suit himself he would, if he chose to build without experiment, pick the same units that are found in the Jordan.

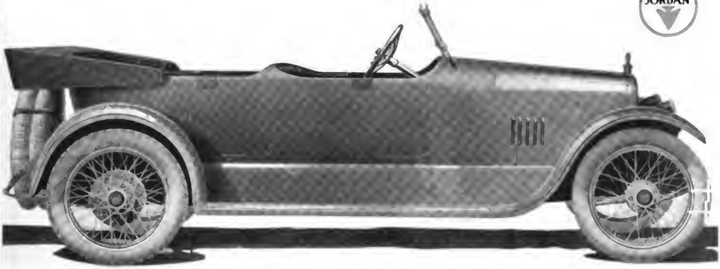
Continental built the modern high-speed, six-cylinder motor, especially for the Jordan.

Jordan equipped it with Bosch D. U. 6. ignition, A. C. spark plugs, and Bijur two-unit, six-volt starting and lighting system.

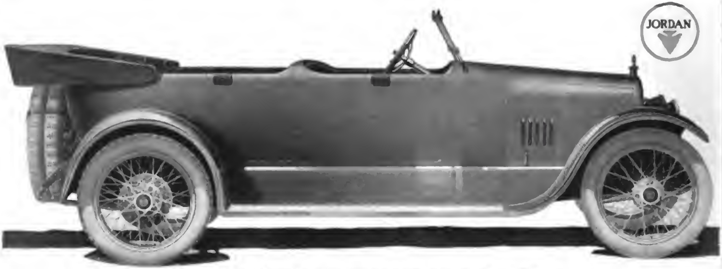
Stromberg designed the carburetor, horizontal, plain tube type.

Russell Begg, the Jordan engineer, designed a perfectly balanced chassis and chose Vanadium steel springs, 59 inches in the rear and 37 inches in front, 2¼ inches wide, semi-elliptic.

JORDAN



The Jordan Four Passenger Sport Model, the most distinctive car in America, selling at $1750, including wire wheels. A model for red-blooded young men



The Jordan Seven Passenger Luxury car which started the nation wide demand for better quality in medium priced cars

Timken built the axle. Timken bearings.

Fedders built the diamond core radiator.

Jordan equipped it with Boyce motometer.

Gemmer built the steering gear and gave the car its short turning radius.

Brown Lipe designed the multiple disc dry plate clutch, and three speed transmission.

Jordan provided the extra long levers and adjustable pedals.

Willard built the Storage Battery.

Firestone furnished the tires 35 x 4½ with non-skid in the rear.

Stewart-Warner designed the vacuum feed, and Jordan gave the car its complete equipment, composed of the finest accessories built in America.

Jordan Style Bodies

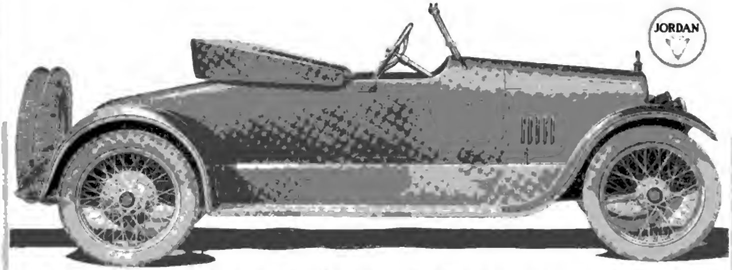
Jordan custom style bodies have established a new ideal in finish and quality of detail at which other manufacturers are now aiming.

It is the first American car in which body lines, finish, and body arrangement in their relationship to the mental and bodily comfort of the passengers, are given first consideration.

Women, who have a broader appreciation for the finer things in motor car finish and comfort, favor the Jordan. In it a woman finds a new kind of comfort and proper poise.

In the Seven Passenger Luxury car, Marshall cushion springs, introduced by Jordan, add an element of luxury which must be felt to be understood.

The woman's judgment is quickly endorsed by the man of the



The Jordan Sixty Roadster, low and rakish, with seats, steering pillar, windshield, levers, and pedals arranged for the man who chooses to be a little bit different

family who recognizes the advantage of buying high priced quality at a medium price.

People who understand the art that lies in simple, distinctive body lines, would choose the Jordan Seven Passenger Luxury car.

The red-blooded young man who loves a car that will get up and go, a car low and rakish in line and snappy in detailed appointments, picks the Sport Model or the Jordan Sixty Roadster.

Those who know the pleasing cleanliness and exclusive comfort of the enclosed type, prefer the Jordan closed cars.

They know that distinction lies in the proper choice of color, texture, finish, and materials as well as in the body lines.

Jordan enclosed types are fashionably low and correct in line.

Jordan designers know that comfort for the well-dressed woman depends upon the seating arrangement, the substantial anchoring of the body to the frame, and the proper construction of the roof to avoid annoying rattles and disagreeable rumbles.

Too often the comfort of a woman has been sacrificed because her hat is constantly striking the back of the car.

Too frequently the driver has been crowded to make more room for the passengers in the rear.

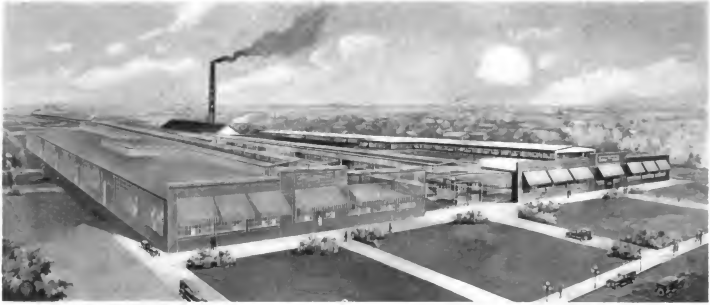
The desire to escape the commonplace has encouraged Jordan to finish the enclosed models in exquisite colors and to upholster them with a choice of rich domestic upholstery or fine French tapestry.

This is exclusively a Jordan idea.

It is the Jordan policy never to appoint a dealer before deliveries can positively be made.

It is a Jordan record that cars scheduled for delivery to dealers have been delivered exactly as agreed.

Jordan production will, of course, have to be increased, but this



The Factory

Ground was broken for the first Jordan building on the right April 5, 1916. The company had outgrown its quarters September 1. The new building on the left, now being erected, doubles its capacity

must be accomplished without sacrifice of care in manufacturing and the closest attention to inspection.

A new addition to the plant which will double its capacity has, therefore, been found necessary. This is now in course of preparation.

The Jordan is represented by well established dealers of recognized standing in many of the most important territories of the country. In others the choice is yet to be made.

The increased daily production to take effect January 1, will enable the Jordan Company to provide immediate deliveries to fifteen new dealers.

The qualifications necessary to successful representation of the Jordan, and a list of those cities to which preference will be given, will be furnished to responsible persons upon application.

Seven Passenger Luxury car	*$1650*	*Jordan Sedan*	*$2350*
Four Passenger Sport Model	*1750*	*Jordan Four Passenger Coupe*	*2300*
(wire wheels regular)		*Jordan Limousine*	*3000*
Jordan Sixty Roadster	*1650*	*(wire wheels $100 extra)*	

Prices F. O. B. Cleveland

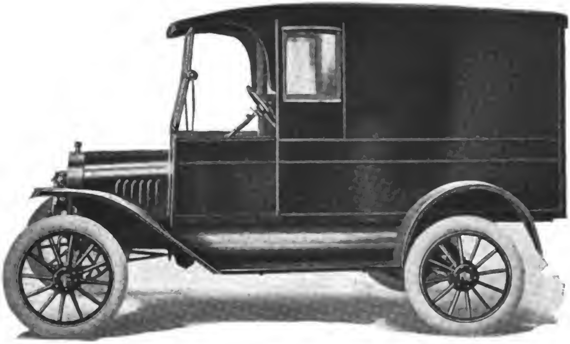
JORDAN

JORDAN MOTOR CAR COMPANY

CLEVELAND OHIO

Rogers & Company, Chicago and New York

Googl



The finest commercial bodies made anywhere in the United States are turned out at the Babcock plant at Watertown, New York.

The finest and most durable materials combined with a patented steel construction make these bodies lighter and stronger than any others, while the absolute appropriateness of their design and finish stamp them at once as signally distinctive.

With a steel skeleton for a base, a structure of the finest native hardwoods (largely ash), and great one-piece side panels of Vehisote, the material that can neither crack, check nor blister, Babcock panel bodies present an **opportunity** to every buyer of a delivery car in the U. S. because they are built to last a business lifetime. (We built carriages that way for 50 years, and carriage buyers say "Babcock" the way jewelry buyers say Tiffany.)

BABCOCK

Their finish (secured by ten and twelve separate coats and rubbings) is brushed on to endure and shine through rain and storm and blistering sun. Lines and colors are pleasing to the eye, and the body as a whole is a moving advertisement of the owner's good taste and prosperity.

And all this at a retail price not much more than is charged for the shoddy jobs you see racked and faded by a few months' use—and **less** than truck manufacturers are compelled to charge for bodies not so good.

It is made possible by Babcock know-how (50 years in the making); Babcock facilities, big capacity, exceptional natural advantages that cut down overhead, and the Babcock ideal of the best **first—only—** and **always.**

***Dealers** in commercial bodies of all descriptions, open and closed, trucks, hearses and jitneys!*

***Agents** for Ford, Ford extensions, Dodge, Maxwell and all other makes!*

***Manufacturers** of ton, three-quarter, and half-ton trucks!*

You can deal with us in any volume to your advantage.

Write us to show you how.

H. H. BABCOCK COMPANY

WATERTOWN FOUNDED 1845 N. Y.

250,000

Cone Clutch Facings

(Fully Protected by Patents)

have just been ordered by one leading car maker. LEATHERTEX Facings will be found on all 1917 models of this car. That's because LEATHERTEX Facings are

- **—More resilient than all-leather.**
- **—More durable than all-leather.**
- **—Cheaper than all-leather.**
- **—Available in thicknesses not to be had in all-leather.**

For these same reasons more than *twenty* widely-known pleasure car and motor truck manufacturers are now using LEATHERTEX. LEATHERTEX is a combination of specially-tanned leather and textile—the two being actually merged into one.

Send cone today (at our expense) and let us make up a LEATHERTEX Facing for your tests gratis.

HIDE, LEATHER & BELTING CO.

227B S. Meridian Street, Indianapolis, Ind.

Detroit Office: 406 Kerr Bldg. W. C. DuComb, Jr., Special Representative

Electric Auto-Lite

STARTING — LIGHTING — IGNITION

A Triumph For Auto-Lite Principles

¶ It is extremely gratifying to know that the early Auto-Lite conception of the proper voltage for electric starting and lighting systems has now been widely adopted.

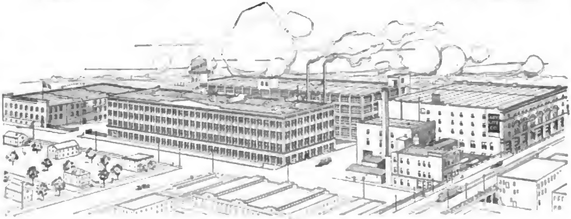
¶ We were the first to advocate and built a six volt separate unit system.

¶ So we are naturally flattered to find that practically without exception other makers have followed our lead.

The Electric Auto-Lite Co.

Head Office and Factory
Toledo - - - - Ohio

Detroit Sales Office
1507 Kresge Bldg.



Home of the Electric Auto-Lite Company

These buildings, of the most modern construction, contain approximately 422,000 square feet of floor space. They are equipped with the most approved modern machinery and are turning out 1400 complete starting and lighting systems every day.

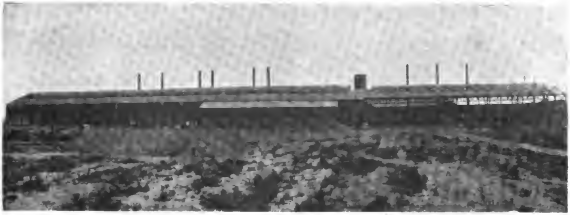
FOR MOTOR CARS MOTOR TRUCKS TRACTORS

LONG MFG. CO., DETROIT, MICH.

PIONEER MAKERS of Gasoline Engine Cooling Systems

The Foundation of United Service

An Efficient Organization
and Modern Equipment



THIS huge building will house the new semi-finishing mills in our plant "B" now being built.

Of most modern construction it affords more light and comfort than is the usual case in mill building. Being light and clean with all machinery electrically operated, the building will employ many efficient makers of "United" Alloy Steels.

Our efficient equipment and experienced organization are responsible for the reputation enjoyed by "United" Alloy Steels.

Chrome Vanadium
Chrome Nickel
Chrome
Silico Manganese
Special Analysis
Nickel
Chrome Silico Manganese
Magnet

UNITED ALLOY STEEL CORPORATION

Successors to
The United Steel Company

Basic Open Hearth *Heroult Electric*

CANTON, OHIO

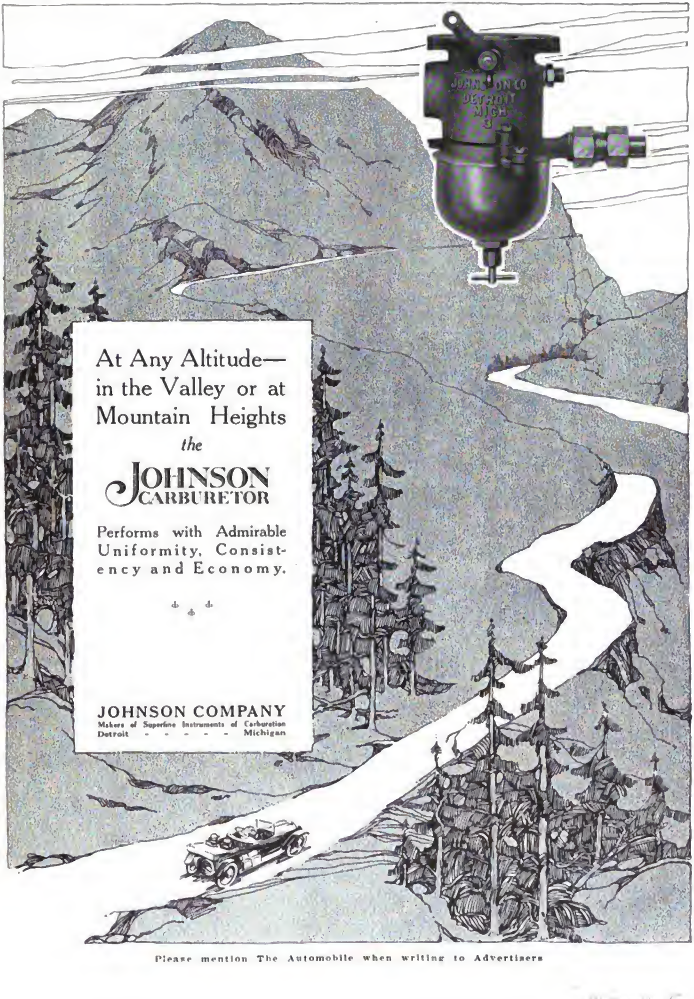
THE FEDDERS RADIATOR

is a product of the best workmanship. It is subject to thorough test. We give our product its character. But you can judge it best however where it is in actual use.

In the mechanical world more than in any other a commodity can be judged by the company it keeps. The quality of the car and truck on which you will find the Fedders Radiator is the best foundation for its reputation. What better foundation can a radiator have for its reputation, among non-users.

The manufacturer producing a reputable product has learned to ask not whether a thing is popular, but, "With whom is it popular?" You will find Fedders Radiators on some of the best makes of pleasure cars and on the largest and most successful trucks. A number of car manufacturers have used the Fedders Radiators since they were first made—nearly twenty years ago.

FEDDERS MFG. CO.
BUFFALO N. Y.



At Any Altitude— in the Valley or at Mountain Heights

the

JOHNSON CARBURETOR

Performs with Admirable Uniformity, Consistency and Economy.

JOHNSON COMPANY
Makers of Superfine Instruments of Carburetion
Detroit - - - - - - Michigan

Departments of Your Plant

Steering Spindle Bolts

These bolts—like spring bolts—are subject to unusual wear and severe road shocks.

We test and select the stock to your specification, heat treat it to give a hard wearing surface and a tough, shock-resisting core.

In quality of steel, finish and accuracy we can give you the same results you would insist on from a "department in your own plant."

THE STEEL PRODUCTS CO. (Main Plant)
CLARKWOOD RD. CLEVELAND, O.

Special Welded Parts

Many difficult problems of chassis design have been economically solved by welding forgings to steel shafts or tubing.

The reliability of this construction is best proven by its long-continued use in some of the leading motor cars.

Keep this process in mind and let us have your inquiries on any such work you contemplate.

Michigan Electric Welding Plant
Hart Ave. Detroit, Mich.

Chassis Bolts

In distinction to the fine hardened and ground bolts shown above there are many bolts used for general chassis work which can be produced to best advantage in this plant.

Send for blue prints showing general types we can produce.

THE LIST INCLUDES

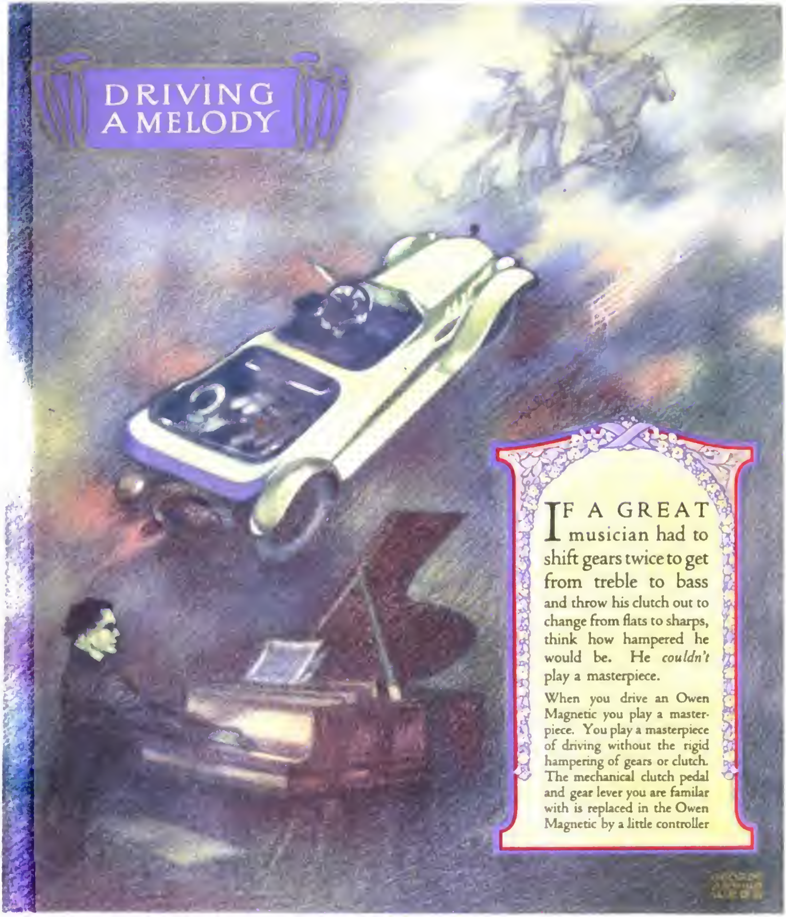
- Brake Bolts
- Housing Bolts
- Support Bolts
- Transmission Bolts
- Radiator Bolts
- Rod Connections

and others names of which are not so well standardized.

Metals Welding Plant
Perkins Ave. Cleveland, O.

Please address inquiries to individual plants

The Steel Products Co.



DRIVING A MELODY

IF A GREAT musician had to shift gears twice to get from treble to bass and throw his clutch out to change from flats to sharps, think how hampered he would be. He *couldn't* play a masterpiece.

When you drive an Owen Magnetic you play a masterpiece. You play a masterpiece of driving without the rigid hampering of gears or clutch. The mechanical clutch pedal and gear lever you are familar with is replaced in the Owen Magnetic by a little controller

Smoothing the Rough Roads

And over the rough roads, or roads rough and smooth in spots where other cars must come back to second for the bad spots and don't bother to go forward into high for a comparatively smooth sixty feet of road, you play in and out, you flash up and down as easily as a sunbeam playing on a wall. You are in high at a finger touch, in first at a finger touch to ease out of a bad hole, in first, in second, in high, with all the infinite variations in between, playing your motor speed with a touch and your infinitely varied gear speeds at a touch, playing both together as Paderewski's master fingers play a sonata, and riding over the rough roads with ease and comfort heretofore unknown.

The Feel of It

And the *feel* of the way the Owen Magnetic rides! You want to *know* what real luxurious floating motion *really* feels like, don't you? Then you must ride in an Owen Magnetic or an Aeroplane.

There is no hard, rigid grip of clutch taking hold, or powerful propulsive force from a series of explosions, coming in contact with the inertia of propeller shaft, transmission and rear wheels, and jerking them into motion. The action in the Owen Magnetic which corresponds to this is the start of a gentle flow of an electric current—driving across an air space, gradually, gently but firmly, grasping the propeller shaft turning it around with a flexible magnetic drive in which all the intermittent power impulses of the engine are absorbed.

BAKER R & L COMPANY, Inc. **CLEVELAND, OHIO**

Manufacturers of **OWEN MAGNETIC MOTOR CARS**

Salesrooms: New York Boston Philadelphia Chicago San Francisco

We Will Protect Your Rights and Ours

A Declaration of Intent and Determination by the Fisher Body Corporation, the World's Largest Builder of Automobile Bodies

AN effort is being made to establish design patent rights to the commonly accepted type of Convertible "All Season" automobile body.

If successful this effort would impose on the buyer ot every motor car equipped with such a body an arbitrary and, we believe, an unjust tax.

We deny the right of any organization or individual to levy such a tax, and we herewith announce our determination to resist with every means at our command any action which may be brought against us to this end.

We believe that, in this stand, we also represent the just rights of every motorist, every motor car dealer and every motor car manufacturer.

Here Are the Facts

Our position is based on our belief that this effort is unwarranted in view of the prior history of the art.

Coaches equipped with removable or collapsible side window structures were in common use long before motor cars became general.

Bodies of this type were mounted on European motor car chassis more than ten years ago.

We ourselves have for some time built bodies of this type, following in our general designs the well-known and long established ideas of English and French body builders, as described and illustrated in technical journals, and confirmed by our own engineer's personal observations abroad.

We believe that these Fisher-built bodies, with which we supply the great motor car manufacturers of America, exemplify the highest degree of refinement yet given this well-known type.

Even the hardware is Fisher-built. Sashes throughout are of steel.

The glass sashes of doors and windows alike slide into recessed compartments at their base.

An ingenious detail permits partial opening of the glass sashes to any degree—a highly desirable advantage as compared with bodies whose sashes must stand either tight shut or wide open.

Each pillar is equipped with a lock and swivel hinge permitting its complete removal and storage in a compartment under the seat, thus making every part of the body self-contained.

We have spared no effort to make these Fisher-built Convertible bodies absolutely noiseless. Padded compartments for panels and pillars combine with accurately fitted workmanship of the world's most experienced body builders to attain this end.

Our Future Course

We believe our pride in these bodies is justified.

We will continue to build them.

We will promptly defend ourselves against any effort to hamper us in their production or to compel us to sell them at an inflated price.

FISHER BODY CORPORATION

DETROIT, MICHIGAN

GUARANTY PLAN
AUTOMOBILE
Time Payments

$2\frac{3}{4}$c. Per Day

GUARANTY PLAN
COMMERCIAL CAR
Time Payments

This is the cost to you per $1000. car of financing your winter Storage on the Guaranty Acceptance Plan.

If because of local needs or legal limitations your own bank can not give you all the assistance you require to finance your winter storage, write us for the facts about the Guaranty Acceptance Plan.

We will help you buy, for storage, as many cars as good business judgment dictates that you should buy—on the cheapest and soundest basis upon which borrowing was ever done.

Mail this coupon or wire the amount you need and on what cars you wish to borrow. Send also your distributor's name if you are not a direct-from-factory buyer.

GUARANTY SECURITIES CORPORATION

Incorporated under N. Y. State Banking Laws

Equitable Building **New York City**

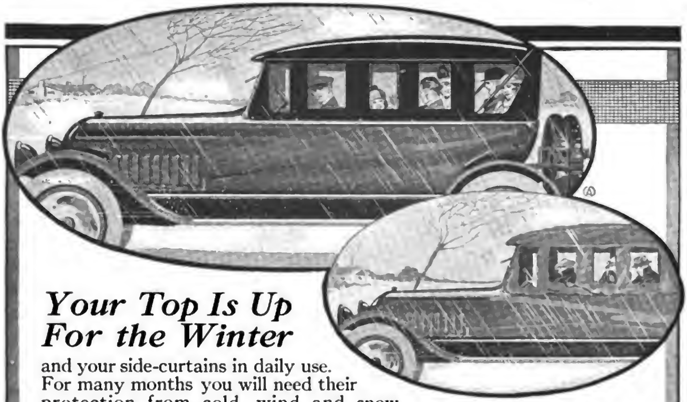
SAN FRANCISCO
Hobart Building

MONTREAL
National Trust Building

Makes of cars represented.........	1	2.................... ..	3....................................
Makes of trucks represented	....	....	....
If you are distributor ✓ here..........	....	....	....
If you are direct factory dealer ✓ here	....	....	....
If you are sub-dealer ✓ here..........	....	....	....
Name of Distributor	....	....	....
Address of Distributor...	....	....	....
No. of cars 1917 Contract..............	....	....	....
No. of trucks 1917 Contract..	....	....	....
Desire financial assistance winter storage on cars amounting wholesale value...........................	$....................................	$....................................	$....................................
I { am using / will use } GUARANTY RETAIL PLAN on cars checked..............	....	....	....

Signature.... .... *Address*..

A. Nov. 30



Your Top Is Up For the Winter

and your side-curtains in daily use.
For many months you will need their
protection from cold, wind and snow

Are they grey and dusty from the summer's dust and wear? If you knew of a preparation with which you, yourself, could easily, quickly, and inexpensively make top and side curtains look like new—would you buy it? If your answer is ***yes***—ask your dealer for

JOHNSON'S BLACK LAC

and a brush and use it next Saturday afternoon. It will only take an hour or two—and the car is ready for use immediately. One coat gives a rich, black, water-proof finish—just like new. After using it your family will be perfectly reconciled to get along without a closed winter body. Also splendid for leather upholstery, tire covers, auto trunks, etc.

It gives as good results on mohair as on leather and imitation leather tops. First wipe off the top and curtains and dry with a cloth. If mohair—brush well with a whisk broom. Then apply Johnson's Black-Lac with a brush—It goes on easily and quickly without a lap or streak. Does not rub off on the hands or clothing.

Worn Metal Parts Made New

Johnson's Black-Lac should be used to touch-up worn, rusty fenders, tire rims, running boards, radiators, lamps, guards—and in fact all metal parts.

It is not only a matter of making your car look better, but in using Black-Lac deterioration, rust and destructive wear are prevented.

If your dealer cannot supply you—don't accept a substitute—but send your order direct to us—we will prepay the express charges. ***Use coupon.***

S. C. JOHNSON & SON
RACINE - LONDON - SYDNEY

ORDER COUPON

S. C. JOHNSON & SON,
Dept. M. A. 12, RACINE, WIS.

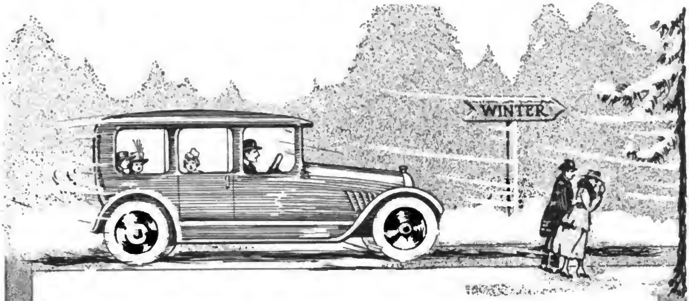
I enclose $1.25 for which please send me by prepaid express 1 quart of Johnson's Black-Lac.

Name ....

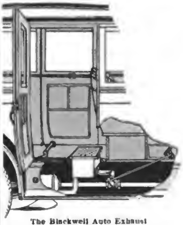
Address ....

City and State ....

My Dealer is ....



You Can't Get Away from Winter but You Can Be Ready to Meet It—And Keep Warm—When It Comes


The Blackwell Auto Exhaust Heater Installed

Seven months out of every twelve you are driving in cold weather—and the rest of the time you are driving **straight to meet it.**

You can no more dodge winter, with its freezing blasts and zero days, than you can freeze water in the glare of the July sun—

But when the cold days come—and they will be here before you realize it—you can be as warm and comfortable in your car as you are at home, if you—

Tell Your Garageman Today to Install the

—BLACKWELL— AUTO-EXHAUST-HEATER

Heats any car—large or small—with a current of **clean, warmed air.** A neat register, **level with the floor,** transmits the heat from air circulation chamber to the car.

Welded Throughout—Not Riveted—Absolutely Fume Proof

Clean outside air circulates in ⅜" asbestos lined duct, surrounding inside chamber of red hot gases direct from the exhaust pipe. Welded steel walls prevent intermingling of exhaust gas and heating air. Steel partitions in inner chamber circulate hot gases 3 times the length of the heater—6 feet in all—insuring sufficient heating area to keep the largest car warm in zero weather.

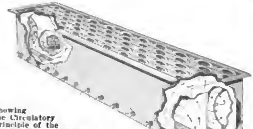
The warmest nights are already too cold for driving without artificial heat. The days will soon be as bad. The BLACKWELL Auto Exhaust Heater is a necessity 7 out of every 12 months. Have yours installed now, and use it for all it's worth.

RETAIL PRICE, $15.00

ASK YOUR DEALER today, or **WRITE US DIRECT**

DEALERS—BLACKWELL Auto Exhaust Heater is a big winter business booster. Seasonable NOW. Write or wire for discounts and details.

DAYTON WELDING COMPANY
DAYTON, OHIO


Showing the Circulatory Principle of the Blackwell Auto Exhaust Heater

BOSCH

IGNITION—LIGHTING—STARTING

THE car of today requires that the electrical apparatus be efficient, fool-proof and simple.

Simplicity is especially desirable, since the owner is best satisfied who can feel that confidence which is inspired by a thorough understanding of the engine and accessories.

The simplicity of the Bosch Electrical Systems is established. The magneto is obviously as simple as an ignition system could be; the Bosch Lighting and Starting Systems are equally as simple and as efficient as the Bosch Magneto.

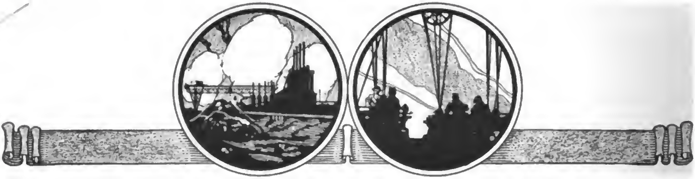
If you desire the utmost efficiency, reliability and freedom from complication in the electrical apparatus of your car, specify Bosch.

Of course you may have catalogues: write now.

BE SATISFIED SPECIFY BOSCH

BOSCH MAGNETO COMPANY

220 WEST 46th STREET NEW YORK CITY, N. Y



Materials

JUST as the weakest link of a chain determines for all time its strength or weakness, the materials entering into an automobile axle definitely predicate its success or failure.

The experience gained in building axles of the highest quality over a long term of years is the basis on which the materials used in Columbia Axles are determined. But we go farther than this. Samples of all materials received at our factory are inspected by a corps of chemical engineers. The slightest deviation from the established standard results in instant rejection.

This constant, unceasing care in the selection of materials coupled with the design that has been proved beyond question through years of successful use, is responsible for the success of Columbia Axles. Today they are used in thousands of the highest grade motor cars. Columbia Axles are an asset of known value to the manufacturer, dealer or user of the cars in which they are installed.

Write for The Columbia Booklet

THE COLUMBIA AXLE COMPANY, CLEVELAND, OHIO

COLUMBIA

AXLES

THIS New Publication tells you the story of Bakelite—shows you that practically every manufacturer of well-known ignition sets has solved his moulded insulation problems by using this wonder material.

Send for Your Copy of
BAKELITE ON THE AUTOMOBILE

GENERAL BAKELITE COMPANY
100 WILLIAM STREET, NEW YORK

55 148

Rear Main Shaft Bearing Cage

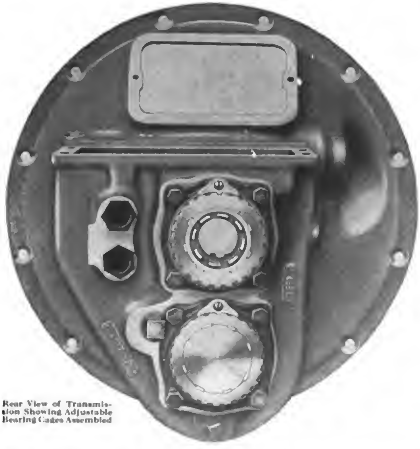
Nickel steel gears and chrome vanadium steel shafts are used in all Brown-Lipe Quality Transmissions.

In addition to this, all Brown-Lipe Transmission Shaft Bearings are mounted in malleable cages, as illustrated herewith. Instead of using the transmission case itself as a housing for the shaft bearings, malleable cages are first mounted securely in the transmission case and the bearings then are assembled in these securely mounted cages.

These are characteristic of the design and manufacture which provide the user of Brown-Lipe Quality products every insurance against trouble, failure and depreciation that is afforded by long experience and the most careful attention to manufacturing detail.

Rear Countershaft Bearing Cage

BROWN-LIPE



Rear View of Transmission Showing Adjustable Bearing Cages Assembled

BROWN-LIPE GEAR CO.

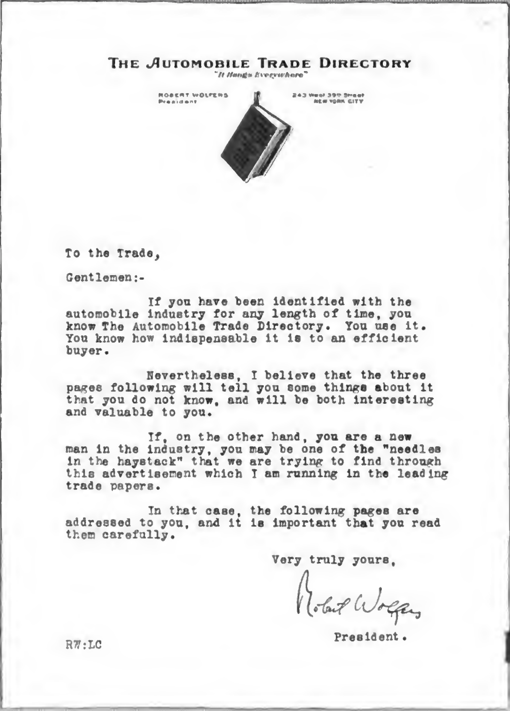
SYRACUSE TRANSMISSIONS N. Y.

BROWN-LIPE CHAPIN CO.

SYRACUSE DIFFERENTIALS N. Y.

NEW YORK, Thos. J. Wetzel, 29 West 42d St.
SAN FRANCISCO, A. H. Coates, 444 Market St.
CHICAGO, K. Franklin Peterson, 122 S. Michigan Ave.
DETROIT, L. D. Bolton, 2215 Dime Savings Bank Bldg.
Foreign Agent, Benjamin Whittaker, 2, Norfolk Street, Strand, LONDON, W. C.

Are you the needle in the haystack?



THE AUTOMOBILE TRADE DIRECTORY
"It Hangs Everywhere"

ROBERT WOLFERS
President

243 West 39th Street
NEW YORK CITY

To the Trade,

Gentlemen:-

If you have been identified with the automobile industry for any length of time, you know The Automobile Trade Directory. You use it. You know how indispensable it is to an efficient buyer.

Nevertheless, I believe that the three pages following will tell you some things about it that you do not know, and will be both interesting and valuable to you.

If, on the other hand, you are a new man in the industry, you may be one of the "needles in the haystack" that we are trying to find through this advertisement which I am running in the leading trade papers.

In that case, the following pages are addressed to you, and it is important that you read them carefully.

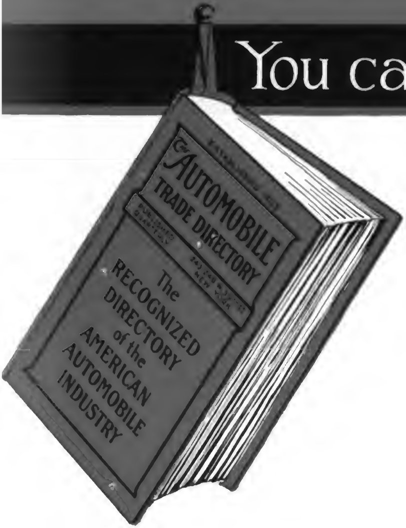
Very truly yours,

Robert Wolfers

President.

RW:LC

You can't keep house


The AUTOMOBILE TRADE DIRECTORY
The RECOGNIZED DIRECTORY of the AMERICAN AUTOMOBILE INDUSTRY

This advertisement is addressed to only a few dealers—

To *legitimate* automobile dealers, supply dealers, garage and repair-shop owners who have not received The Automobile Trade Directory.

This does not include the man who gets together with a few of his neighbors and buys a gross of spark plugs at dealer's prices.

We are not trying to *sell* anything.

We are hunting for the needle in the haystack—a certain few dealers out of thousands.

We have to find them to make good on a promise—and when we find them we will *give* them *without charge* a book which costs us——$100,000 a year to collect, compile and distribute.

This $100,000, 894-page book contains a complete list of the names and addresses of every manufacturer of automobiles, parts, accessories, machinery, tools or material in any way connected with the automobile industry, together with the trade names of their products, and in many cases a detailed description of each—all classified and indexed, so that it takes but a moment to find all the manufacturers of any particular line.

This book hangs on the desk of practically every purchasing agent of these manufacturers, and *also* on the desk of the buyers of practically every wholesale or retail supply house, automobile dealer, garage and repair shop in the United States.

If it does not hang on *your* desk, *you* are one of the "needles in the haystack" that we are trying to find by this advertisement.

It should hang on your desk for the same reasons that it hangs on the desks of all the other men in the industry

Because it is a convenience

You cannot keep in any usable way the thousands of catalogs of every size and description which you get in the mail—even if you have the time and inclination to do it and the necessary space. Even if you kept every one you received, you could never have a complete file.

One dealer we know of by actual count received 369 catalogs during one month, ranging in size from a geography to a pocket brochure.

without this $100,000 book

As a matter of fact, it cost us $112,634.43 to collect, compile and distribute this book during 1916.

In The Automobile Trade Directory you can find in a few seconds, grouped together conveniently, all the spark plug makers, all the tire makers, all the lamp makers, all the battery makers, all the makers of any device allied with the automobile industry.

Because it is a necessity

You must have some place to turn to quickly for complete and condensed buying information. The Automobile Trade Directory—and nothing else—gives this to you.

Because it is reliable

It costs thousands of dollars every year to keep the editorial matter in The Automobile Trade Directory absolutely accurate. We could have it fairly accurate and save $10,000 a year, but a directory that isn't complete is useless. For 13 years The Automobile Trade Directory has proved to be the only absolutely complete buyer's reference book in the field.

Because it is the standard catalog of the industry

You can find in the Directory the names and addresses of every manufacturer, with the trade names of his products, and illustrations and descriptions of thousands of articles. Many of the most progressive manufacturers have incorporated in it their *entire catalogs* displaying complete lines with full buying information, including types, list prices, discounts—and the number is steadily increasing.

You can buy much of your stock directly from cuts, descriptions, prices, discounts given in The Automobile Trade Directory, without having to take the trouble and waste the time in writing to the manufacturer.

We have guaranteed the manufacturers who advertised in The Automobile Trade Directory in 1916, that a copy of this directory would be sent to every single purchasing agent of every company manufacturing automobiles, motor trucks and motors and to every single legitimate automobile dealer, supply house, garage and repair shop in the United States. We have promised

not 99.44% but 100% circulation

—as nearly as this is humanly possible—and we intend to make good on this promise.

We own the most complete and accurate list that has ever been compiled. We have sent a copy of The Automobile Trade Directory to every one of the 48,731 names on this list.

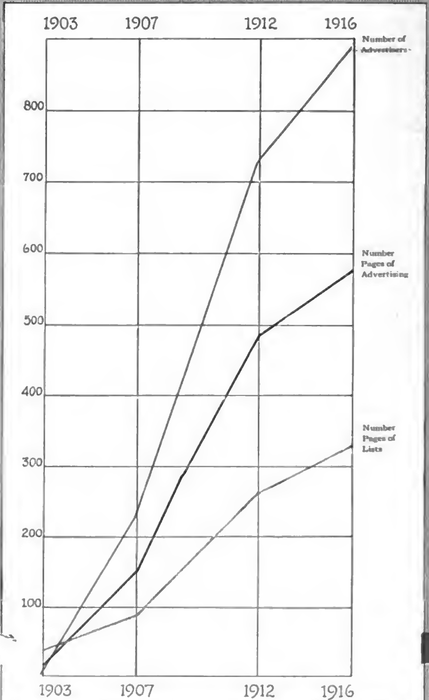
To locate the few needles in the haystack, which we may have missed, we are searching for them through advertisements in the leading trade papers.

If you are a legitimate dealer and have not received during 1916 a copy of The Automobile Trade Directory, write us on your business stationery and we will send you absolutely free of charge this $100,000 book to hang on your desk, without which you can't "keep house" efficiently. Don't postpone this—you might forget it. Do it now—you need this book.

Robert Wolfers.

President

The growth of a $100,000 book



SILVERTOWNS

TRADE MARK

The President of the Peninsula Rapid Transit Co.,
San Mateo, Cal., wrote:

"Our Grand Average Is 7,000 Miles on Silvertowns"

After every other tire had failed, the Peninsula Rapid Transit Co., in San Mateo, Cal., equipped its enormous 10,000-pound, 24-passenger busses with Goodrich Silvertowns.

For a year they battered and thumped those Silvertowns—the strain was terrific.

Then President Pearson of the Company wrote to us:

"We are satisfied! There is nothing better than Silvertowns on the market. Our grand average is 7,000 miles per tire."

Think of it! If Silvertowns will endure such strain in bus service, how much more they can do on your car!

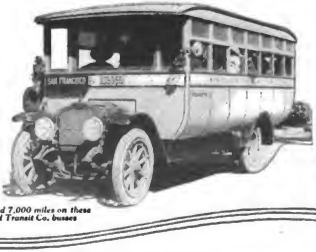
The secret of Silvertown success lies in its construction—two plies of CABLED-CORDS and a tread of Black "BAREFOOT" Rubber, both features exclusively Goodrich. You can't buy them in other tires.

The Strength and Resiliency of Silvertown construction has made this tire equipment on most of the large gasoline cars and practically all of the electrics made in this country. This is the Silvertown you have read about—that has won such sweeping victories on speedways and in trans-continental runs in the last two years.

Patented and made exclusively by

The B. F. Goodrich Co.
Factories: Akron, Ohio
Branches and Dealers Everywhere

Made by the makers of
TEXTAN
The wonderful new Sole for
your Shoes



Silvertowns averaged 7,000 miles on these Peninsula Rapid Transit Co. busses

Between the Load and the Road

are the Axles and Springs, the parts that determine whether the truck is going to "get there" with its load, and how much it's going to cost to do it.

Do you realize, Mr. Truck Buyer, that these three factors

1. How steadily a truck runs,
2. How much it costs to keep it in condition to give continuous service, and
3. How little it depreciates in performing this service,

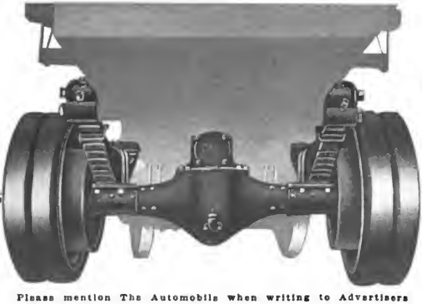
are what really determine the value of the truck. Purchase price, often the deciding factor in the choice of a truck, is not a reliable guide. Usually the cheapest truck to buy is the most expensive to maintain—the hardest to keep in operation—the quickest to depreciate.

SHELDON

SHELDON Axles and Springs are the highest priced on the market, hence SHELDON-equipped trucks generally bring a higher price than trucks equipped with other makes of Axles and Springs. But SHELDON-equipped trucks are CHEAPER IN THE END because the extra money represents value, and value in Motor Trucks means low upkeep, constant operation, and little depreciation.

Hadn't you better learn all about it? We'll be glad to send full particulars and give you a list of SHELDON-equipped trucks on request.

**Sheldon
Axle
&
Spring
Company**



**Wilkes-Barre
Penna.**

3

"America's Greatest 'Light Six'"

HAYNES

"America's Greatest 'Light Twelve'"

No Element of the Experimental Enters Into a Dealer's Choice of the Haynes. ❧ ❧ Haynes Missionary Work Has All Been Done. ❧ ❧ Haynes Cars Are 24 Years Past the Probationary Stage. They Have Their Reputation and It Is an Enviably Good One. Haynes' Spurs Have Long Been Won.

THE HAYNES AUTOMOBILE COMPANY
3 S. Main St. Kokomo, Ind.

HAYNES
AMERICA'S FIRST CAR

A Limited Number of New Haynes Dealerships Are Now Available for 1917. Wire, Write or Call at the Factory for Full Particulars : :

Four Passenger Roadster
"Light Six"
$1585
"Light Twelve"
$2085

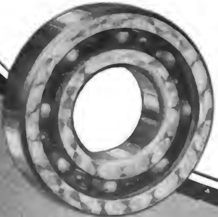
U. S. BALL BEARINGS
IN A MODERN, NEW
WITH A CAPACITY
BEARINGS

BALL BEARINGS offer least friction to the transmission of power
BALL BEARINGS offer exceptionally great carrying capacity
BALL BEARINGS wear longest
BALL BEARINGS have won every racing classic
BALL BEARINGS are used by practically every foreign manufacturer
BALL BEARINGS are always found where efficiency dominates cost

U. S. BALL BEARING

Conrad Patent Licensee

Palmer Street and Kolmar Avenue,



The U. S. Ball Bearing : : :
"The Balanced Bearing."

U.S.

BALL BEARINGS

ARE MANUFACTURED
LY EQUIPPED FACTORY,
OF 10,000 QUALITY
DAILY

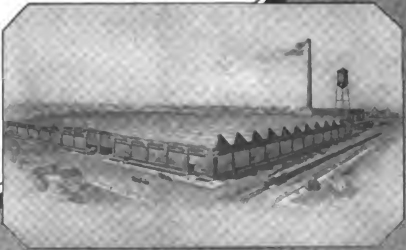
¶ Evidence of the character of U. S. Ball Bearings is shown in the fact that within four years' time the U. S. Ball Bearing Mfg. Co. has advanced from an obscure position to one of the largest manufacturers of high grade ball bearings in the world.

¶ This position of prominence has been attained fundamentally because all U. S. Ball Bearings are Quality Bearings—quality not alone from the standpoint of material used, but in manufacturing practice and design as well.

¶ Particular attention is called to the fact that one of the quality characteristics of U. S. Ball Bearings is that these bearings are what we term "balanced bearings";—balanced, in that there is just the right number of balls to supply the correct capacity to the proper sized raceways—that is, each component of the finished bearing is in perfect balance as to capacity and performance with each other component.

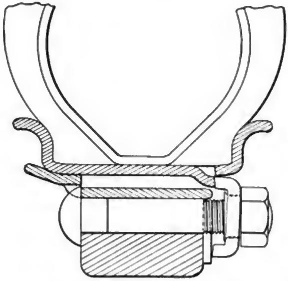
MFG. CO.

CHICAGO, ILL.



This magnificent factory is devoted exclusively to the production of U.S. Ball Bearings.

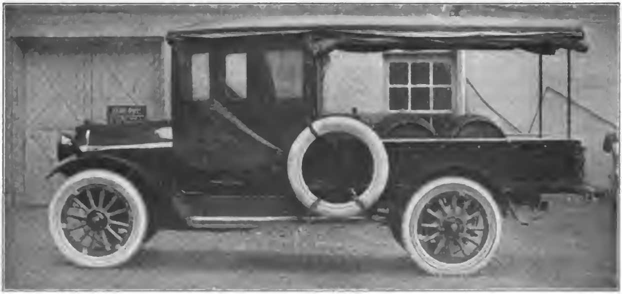
BAKER NEW TYPE RIM WITHSTANDS



—The Rim with a 100% margin for safety

The Reo Motor Car Co. tested out the newest type of Baker Rim on one of their light trucks carrying three barrels of water weighing 1500 pounds dead weight. This truck was driven for six weeks over the roughest roads to be found in Lansing and vicinity and the rim came through with flying colors. This test showed that the rim was self-centering, would run perfectly true and that it would not wear, get loose or squeak in service. The rims used in this test were the same as will be furnished to the manufacturers and contained the usual six clamp lugs.

While this six weeks' test was convincing to the Reo Engineers, they desired to learn the reserve strength of the rim for safety and lasting service, so they removed every other lug on the rear wheels—leaving only three clamp lugs on each rear wheel instead of the usual six. They sent the truck out for two weeks more over the same roads carrying the same three barrels of water. This two weeks' test proved that the New Baker Rim could not be thrown



Reo Light Truck equipped with Baker New Type Rims loaded with three barrels of water weighing 1500 lbs.

GRUELLING TEST BY REO ENGINEERS

from the wheel while held on by only three clamp lugs, and, in addition, showed no looseness or squeaking or any indication that the same would develop. Its performance with half of the lugs removed thus demonstrated the normal mounting to be 100% overstrength.

Read Engineer Thomas on Baker Rim Performance

REO MOTOR CAR COMPANY
Lansing, Michigan

November 20, 1916.

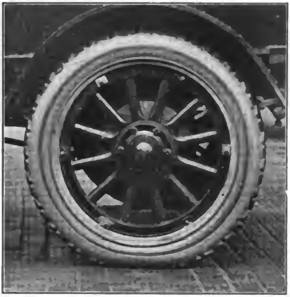
Mr. Erle K. Baker,
Universal Rim Co.
1502 Michigan Ave.
Chicago, Ill.

Dear Sir:

Replying to your recent inquiry regarding a set of 34 x 4½ inch Baker rims we have been testing out, will say that these rims were placed upon one of our light trucks carrying a 1500 pound load and have been driven about six weeks. No difficulty was experienced with squeaky or loose rims. About two weeks ago we removed three of the six clamps on rear wheels and so far these three clamps seem to be holding the rims in a satisfactory manner

We are enclosing photographs of the truck with these rims in place.

Yours very truly,
REO MOTOR CAR CO.,
Signed (H. T. Thomas,)
Engineer.



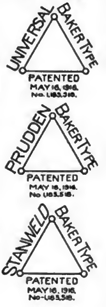
Baker New Type Rim Running with Three Lugs Removed

Description of the Baker New Type Rim

In the form tested by the Reo company the Baker rim is an even further departure from what the industry has known as "rim construction" than the types that have preceded it. It is of the "off-side bearing" type, self-centering, free from distortion, absolutely rigid in service, as many different tests have proved. Load bearing contact with the rim is provided by its "clutch-cone" seat upon the flange. It is forced into engagement by lateral pressure of the lugs, which bear against integral abutments in the rim and against the outside of the felloe. Even the centering buttons have been eliminated. Their purpose of guiding the rim during the process of mounting now is served by offsets in the felloe band, which also provide clearance for the bolt heads. Besides simplifying in other ways this construction enables us to use standard bolts, instead of special ones. It is another evidence of our continued effort to evolve better results by simpler means. This is but one of the many forms of Baker rim that we have tested and published. In a number of ways we think it is our best.

***Other manufacturers are testing these rims.
We want to include you among the number.***

LOOK FOR
THE 3 POINT STAMP
ON ALL RIMS



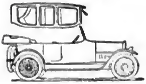
UNIVERSAL RIM COMPANY

1502 S. Michigan Ave. CHICAGO, ILL.

KISSELKAR The ALL-YEAR Car

EVERY INCH A CAR

Kissel's Original Idea That Changed the Motoring Habits of a Nation



The Hundred Point Six

The car of a Hundred Quality Features — that caused a stampede among careful car buyers everywhere 48 hours after it was first announced.

Hundred Point Six ALL-YEAR Models

Mounted on Gibraltar Body

Touring-Sedan	$1635
Roadster-Coupe	$1635
Victoria-Town Car	$1950
braltar Body Without Top,	$1295

De Luxe Six 42

Five Passenger Touring	$1650
Seven Passenger Touring	$1750
All-Year Sedan	$2000

THE pleasures of the theatre, opera or dance are enhanced by the harmonious interior of your ALL-YEAR Car.

It is hard to conceive more genuine comfort built into a car than is found in the new ALL-YEAR Sedan.

The ALL-YEAR Top ***fits in***—not on. Here is a convertible body that cannot be had with ***any other car***. It is exclusive—***not*** commonplace.

In Spring your ALL-YEAR Sedan is quickly changed to a wide-open, roomy, ***roofless***, touring car—in whose performance and comfort there is nothing lacking.

DEALERS—No particular motorist will ever be satisfied with a body that can be had with a car selling for several hundred dollars less than the one he buys—he will not accept a stock job.

If Kissel's ALL-YEAR Cars are not represented in your city or town, it will pay you to write or wire us today for business particulars.

Kissel Motor Car Company
Hartford, Wis., U. S. A.

MICHELIN

Michelin does almost everything for his tire dealers — except giving their customers the money to buy with

And just incidentally, Michelin does give them money to spend with you dealers for other things—the money saved—as Michelin Tires sell so much lower than other quality makes.

So first of all Michelin gives you, at very low list prices, the best tires that can be made, and then, through his new co-operative plan, sends new customers to your store.

MICHELIN
How to Reduce One Item of Motoring-Expense:
MICHELIN
Red Inner Tubes
MICHELIN
MICHELIN
QUICK DETACHABLE CLINCHER
MICHELIN
Universal Tread
The New Tire Everyone Is Talking About
The Non-Skid Tread combines in One Tire all the Advantages of both the Button Tread and the Raised Tread Types.
Prices Moderate and Quality the Best!
DEALER'S NAME AND ADDRESS
BARGAINS
Automobile Parts
MICHELIN

Michelin's

big national and local co-operative advertising not only sells your tires for you, but also helps increase your other business.

If you're looking for a means to decrease selling costs and minimize selling effort (at the same time that you are building up and increasing your entire business) ask us to tell you all about the new up-to-the-minute-sure-fire Michelin dealers' co-operative proposition.

But—

If you don't write—and miss it, without even looking at it to make sure—you have missed the greatest dealer proposition ever conceived—and the chance for an unusual and certain boost to *your whole business.*

MICHELIN TIRE COMPANY

MILLTOWN - - - - - - - - NEW JERSEY

The increasing predominance of **GURNEY BALL BEARINGS** throughout the manufacturing world indicates the growing recognition of their superior quality.

They allow for greater loads at higher speeds, and will stand thrust loads far in excess of what any other bearings of any kind are capable of standing.

GURNEY BALL BEARING COMPANY
Conrad Patent Licensee
Chicago, Ill. Jamestown, N. Y. N. Y. City

Real Comfort This Winter in Your Open Car!

Expensive Detachable Glass Tops or Bodies No Longer Necessary

The Old Way

If you wish to save the expense of a limousine or a detachable top, a very small sum will make your touring car or roadster just as comfortable and convenient for cold weather driving.

÷ BLACKMORE ÷ DOOR CURTAIN OPENERS

These openers give you all the advantages of a car enclosed in wood or glass. No extra top or body is necessary. With slight alterations of your curtains will fit any touring car or runabout.

They enable you to open the doors and step in and out just as you would if your car had a closed body. No buttons to fuss with, no curtains to bother you.

With the Blackmore Door Curtain Opener

The patented Blackmore Openers are simple, inexpensive steel supports for the door curtains. They make them as much a part of the body as the doors of a limousine. Once you have attached them you can forget all about your curtains until spring. The openers can be instantly detached and put away with the curtains.

Don't "Put Up" Your Car This Winter!! — See Your Nearest Top Maker Today

Standard Equipment on 1917 Models. Packard, Cadillac, Studebaker, Reo, White, Franklin, Jackson, Locomobile, Chalmers

DAYTON TOP IMPROVEMENT CO., Dayton, Ohio

PATENT NOTICE: This opener is the original one. It has been introduced and developed by us during the last eight years. Infringements will be subject to the usual legal steps to protect our rights.

Economy of Current Consumption Positive Unfailing Action—

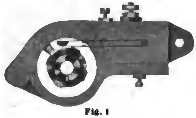


Fig. 1

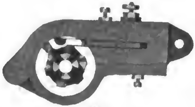


Fig. 2

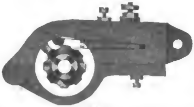
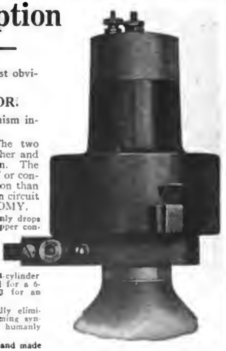


Fig 3.

—are the two points of superiority most obvious in the

PITTSFIELD DISTRIBUTOR.



An open circuit and a breaker mechanism independent of springs.

Look at these three illustrations. The two small platinum points are forced together and then forced apart by the revolving cam. The cam is so shaped that while the "make" or contact is firm it is of much shorter duration than the "break" action, thus leaving an open circuit most of the time. This means ECONOMY.

Notice particularly that the cam action not only drops the lower contact point, but pushes up the upper contact point, to break the contact; also that it lifts the lower and drops the upper to make contact. This means POSITIVE UNFAILING ACTION — MECHANICAL ACTION.

The cam action in Fig. 1 is designed for a 4-cylinder engine; the cam action in Fig. 2 is designed for a 6-cylinder engine; the cam action in Fig. 3 for an 8-cylinder engine. Count the cams!

Electrical and mechanical lags are practically eliminated by this simple, positive action, and timing synchronization made as nearly perfect as is humanly attainable.

The whole ignition outfit is simple, compact, and made into a single unit, including the coil.

WRITE FOR COMPLETE DETAILS

PITTSFIELD SPARK COIL COMPANY
PITTSFIELD ☐ ☐ ☐ ☐ MASSACHUSETTS

National Speedway Tires

—a good, solid, honest-value tire at a reasonable price?

Though low in price, this NATIONAL "*Speedway*" Tire has the strength, the stamina, the appearance, the workmanship and the *plus* value you want in a tire.

It wins buyers and keeps them because it consistently delivers more than the average amount of mileage and successfully stands more than the average amount of punishment.

During the past year the NATIONAL "*Speedway*" Tire has established a great name for itself.

From the first day it was introduced it created a demand that completely overtaxed our capacity and has been the cause of increasing NATIONAL production ten-fold—*all within the short space of a year.*

DEALERS

Our sales plan will enable you to sell these tires with more satisfaction, cleaner profits and a more permanent basis of business-building.

It is conceded by successful tire dealers that an exclusive territory for a well-advertised tire that has proved its worth and sells at a reasonable price is the very best tire proposition obtainable.

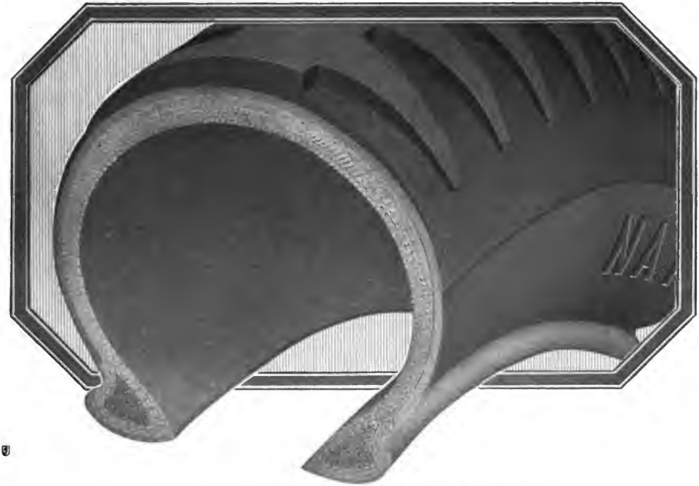
We can offer you just such a proposition. You will *not* have to compete for business against cut-rate competitors, curbstone brokers, and *the factory itself*, selling the same make of tire.

Get an idea of what we can do for you.

Let us tell you about the good things in store for our dealers. Write us to-day.

We are making contracts for 1917 NOW.

National Rubber Company, Pottstown, Pa.



Judge Its Quality by the Company It Keeps

FOSTER OWL LIGHT

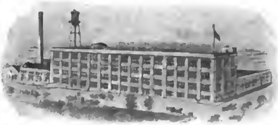
There is no more certain evidence of a car owner's discrimination and good taste than the presence of a FOSTER Owl Light on his windshield.

The highest-priced, finest built cars in the world carry the OWL Light. It is a badge of distinction. It is simple, neat, ornamental, and unobtrusive. There is nothing complicated, awkward, bulky or ugly about it. It is the handsomest spotlight possible for spotlight specialists to build.

Now only $5, complete with all connections. Sold on 10 days' trial. Ask your dealer, or if he cannot supply you, write us direct. In ordering, state make, model and battery voltage of car. Send for interesting booklet.

Thoroughly high-grade dealers wanted. Write.

C. H. FOSTER ACCESSORIES CO.
2303 Michigan Blvd. Chicago



Use the facilities of this perfectly equipped plant for the production of small sheet metal stampings of any design, also

BRASS CASTINGS
in the Rough, Polished or Nickel Plate

Including Hub Caps, Radiator Filler Necks with Caps, Gasoline Tank Flanges with Caps, Gasoline Tank Flanges for Outlets, Hood Yokes, Ford Special Hub Caps and other parts made of Cast Brass.

Our Well-Equipped Wood-Working Department

is prepared for the prompt production of quantity orders of rough or highly finished wood-work assemblies of medium size for motor car construction, such parts as rest blocks for shipping, flooring boards, back spring boards, running boards, etc.

We work from Blue Prints and Specifications, but prefer, when possible, to also have samples for the purpose of securing positive accuracy in weight, measurements and design.

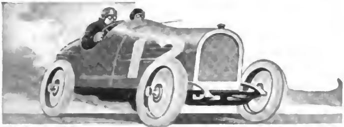
Write us at once for further information regarding the production of your requirements.

The Pfau Mfg. Co. PFAU SERVICE **Cincinnati Ohio**
230 Mentor St.

THE MARK OF A BETTER RADIATOR

QUALITY
RADIATORS
FOR
PLEASURE CAR
AND
HEAVY DUTY SERVICE

G & O MFG. CO.
NEW HAVEN CONN.

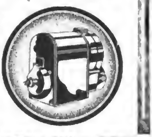


Faster! Faster! Faster!

Speed—power—they call for *perfect ignition*—a spark so flashing, burning hot that the mixture doesn't matter. Richest mixture to leanest, you'll get a full explosion every time if you have an

EISEMANN

MAGNETO



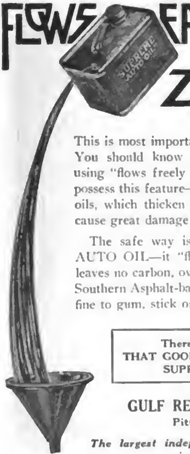
Just as good at lower speeds, too. Even when your motor is barely turning over, the Eisemann spark is hot and powerful.

EISEMANN MAGNETOS are so dependable and efficient that 108 manufacturers of Pleasure Cars, Trucks, Tractors, etc., have adopted them as standard equipment. That should mean something to you!

THE EISEMANN MAGNETO CO.

Sales and General Offices
32-33d St., Brooklyn, N. Y.
802 Woodward Ave., Detroit, Mich.

FLOWS FREELY AT ZERO



This is most important during winter months. You should know whether the oil you are using "flows freely at Zero." All oils do not possess this feature—notably the paraffine base oils, which thicken up under cold, and often cause great damage to the motor.

The safe way is to ask for SUPREME AUTO OIL—it "flows freely at Zero," and leaves no carbon, owing to the fact that it is a Southern Asphalt-base oil, containing no paraffine to gum, stick or thicken.

There is more Power in
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Recent performances of the Franklin Car practically marked a new epoch in engine efficiency and endurance. It is characteristic of the high standard of quality followed in every detail of construction and equipment by the Franklin Company that the standard carriers for gasoline on these cars are "Jasco" Tanks.

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Fifty simplified instructions with 1750 illustrations treating every detail of the automobile from the principle and construction to valve timing, etc., with examination questions which bring out just those points you want to know and ought to know—points you would never gain by reading a book.

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1—Working model of 6-cylinder "L" head engine.
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All packed in a neat box with full instructions.

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Lord Montagu of Beaulieu, member of the House of Lords and founder of the great Brooklands automobile tracks near London, writes: "I have read your Auto Instructor and consider it to be of great value." Elwood Haynes: "I regard this as just the kind of instructor needed, in order to show not only the mechanism, but to show it in actual operation." Chas. Duryea: "I did not think it possible to get so much real information into such an instruction and yet keep it so concise and simple." Barney Oldfield: "If a person can't learn from this he can't learn at all." Elbert Hubbard (deceased), said: "Your proposition seems to me the most reasonable and direct method of teaching a beginner."

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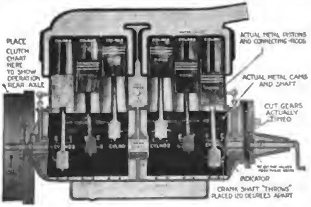
The Dyke Method of Teaching by Mail is a new idea. A new invention. Working models are used on which you can see the parts in actual operation.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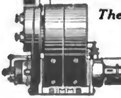

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The first touch of cold weather, last week, set stiff motors sputtering and car owners cranking until their batteries ran low, or their arms gave out. It was the forerunner of the every-morning job of trying to start a cold motor—a job you are elected to every day this winter, unless you use a PRESTO-Electric.

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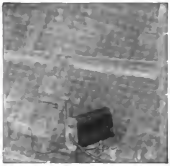

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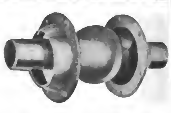

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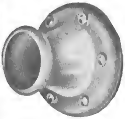

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Showing Spring Nut Lock applied loose on bolt before being set in place to hold until taken off.

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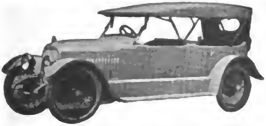

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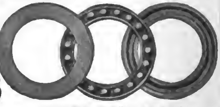

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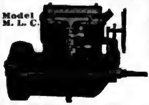

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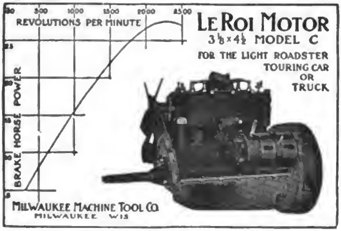

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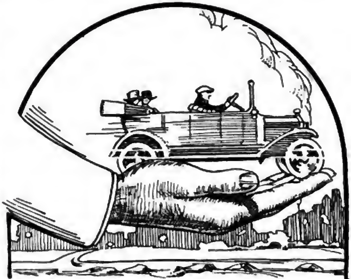

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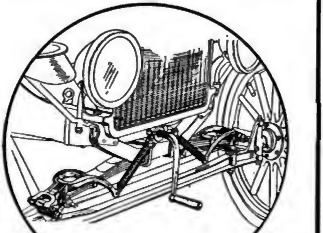

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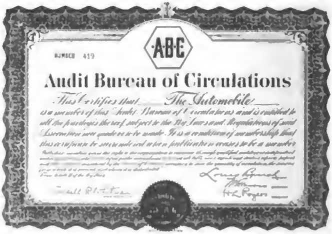
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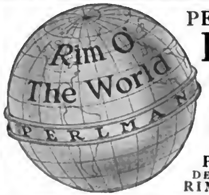

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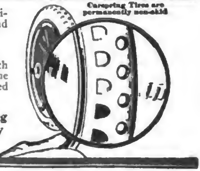
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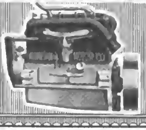

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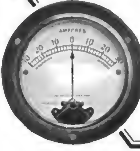

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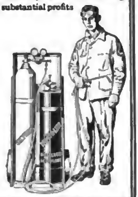

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For Your Car
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For Second-Hand Cars, Surplus Parts, Accessories, Tires Machinery & all other Special Announcements of a Similar Character

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Stanweld 32 x 3½ straight side rims	$ 2.50
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Firestone 34 x 4 Universal rims	2.30
Firestone 36 x 4 Universal rims	2.55

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Jacox right hand drive steering gears with 18" wheels	10.00
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18 inch corrugated steering wheels with aluminum spiders, each	3.00

Many sizes and types wheels, $1.25 each and up

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Continental 4 cylinder motors, complete with magnetos; coil; clutch; transmission; generator. Special price	200.00
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Write for a copy of our illustrated Bargain Bulletin. It contains many bargains not listed here.

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NOW THE TIME!!

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Radiators, give model and car or dimensions, some good as new, from hundreds of cars, prices from $15 to $30.

Cylinders all kinds on band from cars we dissemble, A1 shape, $5 to $15.

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All sizes, good for all winter, low as	$5.00
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Cadillac 4 cyl. 1911	$85
Regal 4 cyl. "30"	60
Rambler 4 cyl. model 55, 40 H.P.	65
Franklin 4 cyl. air cooled	45
Below with unit transmission.	
Hupmobile "20" 4 cyl.	$65
Cole "50" 4 cyl. either left or right control	85
Krit 4 cyl. cast en-bloc	85
Herreschoff 4 cyl. cast en-bloc, L. or R. con.	85
Rutenber 6 cyl. cast separate, Warner trans.	125
Brownel-Trebert 6 cyl. in pairs valve in head	100

Above engines in first class condition, complete with pumps, manifolds, carburetor, fan, everything.

BOSCH MAGNETOS.

D U4 variable spark $30; set spark D U4	$25
D U6 $35; Mea 6 dual $30; K W 6	25
Eisemann 4 cyl. water-proof type	30
Eisemann 6 cyl. H.T. $30; Dixie 6 cyl.	32
Bosch Z R4 water-proof, dual type	35
Eisemann 6 cyl. low ten. with coil	20
Simms 4 cyl. dual type $25; K W 4 cyl.	15
Bosch D R 4 cyl. dual $30; Bosh D R6	30
Bosch late type dual coils (inset)	8

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Rayfield, Stromberg, Schebler, others, low as	$5
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Rear axles with unit trans.	40
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Above axles are complete with hubs, bearings, reach-rod, brakes, drums, everything.

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Engines, Gears, Bearings, Axles, Crank Shafts, Cylinders, Transmissions, Wheels for nearly any make of car.

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Cast iron and magnalite aluminum.

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High compression and plain.
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Will increase speed and power, reduce vibration and eliminate carbon trouble. We are the first in New York to offer these pistons to motorists. **Get our prices on regrinding cylinders and for ALUMINUM ALLOY PISTONS.**

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WE REGRIND CYLINDERS

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fitted with light pistons and LEAKLESS RINGS.

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29x2¾, nonskid, new, $5 each.

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32x3½	8.05	2.40
34x3½	8.95	2.50
30x4	9.35	2.55
31x4	11.50	2.65
32x4	11.60	2.70
33x4	11.90	2.85
34x4	12.10	3.05
35x4	13.25	3.10
34x4½	14.30	3.25
35x4½	14.95	3.40
36x4½	15.35	3.65
37x4½	16.90	3.75
35x5	17.10	3.80
36x5	18.45	3.90
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33 x 4	9.85	10.85	3.10
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34x3½	9.50	2.55	36x4½	17.50	4.25
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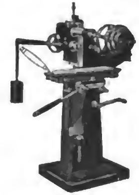

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Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

American Ball Bearing Co. 111
American Bronze Company 48
American Sheet & Tin Plate Co. 111
Atwater Kent Manufacturing Works 105
Automobile Engineer 102
Automobile Trade Directory 77-80

B

Babcock Co., H. H. 57
Baker R & L Co. 65-68
Bearing Co. of America 100
Beaver Mfg. Co. 101
Bosch Magneto Co. 73
Bossert Co. 98
Braender Rubber & Tire Co. 102
Brown-Lipe-Chapin Co. 76

C

Celfor Tool Company 100
Central Steel Company 114
Champion Ignition Co. 98
Cincinnati Storage Battery Co. 100
Columbia Axle Co. 74
Columbus Varnish Co., The 97
Continental Motor Co. 100
Corcoran-Victor Co. 104
Cullman Wheel Co. 111

D

Dayton Top Improvement Co. 92
Dayton Welding Co. 72
Dyke, A. L. 96
Dyneto Electric Co. 103

E

Eclipse Machine Co. 96
Edmunds & Jones Corp. 105
Eisemann Magneto Company 95
Electric Auto-Lite Co. 59
Electro Metal Products Co. 102
Engineering & Tube Bending Works 111

F

Fahrig Metal Co. 100
Fedders Mfg. Co. 62
Firestone Tire & Rubber Co. 102
Fisher Body Corporation 69
Foster Accessories Co., C. H. 94

G

General Bakelite Co. 75
Gibson-Hollister Mfg. Co. 101
G-O Manufacturing Co. 94
Goodrich Co., B. F. 81
Grossman Corp., Emil 102
Guaranty Securities Corp. 70
Gulf Refining Company 95
Gurney Ball Bearing Co. 91

H

Hartford, E. V., Inc. 1
Hawthorne Mfg. Co., Inc. 102
Haynes Automobile Co. 83
Hide Leather & Belting Co. 58
Horton Mfg. Co., F. L. 113
Houk Mfg. Co. 101
Hudson Motor Car Co. .... Front Cover
Hyatt Roller Bearing Co. 104
Hydraulic Pressed Steel Co. 99

I

Indiana Rubber & Insulated Wire Co. 104

Index to Advertisers

J

Janney-Steinmetz & Co. 95
Johns-Manville Co., H. W. 103
Johnson Company 63
Johnson & Sons, S. C. 71
Jordan Motor Car Co. 49-56

K

K-W Ignition Co. 98
Keystone Vehicle Co. 99
Kissel Motor Car Co. 88

L

Liberty Cut Glass Works 112
Liberty Motor Car Co. 105
Long Mfg. Co. 60

M

Manzel Bros. Co. 103
Mercer Automobile Co. 103
Merrill Spring Co., E. R. 111
Metal Specialties Mfg. Co. 97
Michelin Tire Co. 89-90
Milwaukee Machine Tool Co. 101
Moltrup Steel Products Co. 100
Motor Age 104
Motor World 111
Mutty Co., L. J. 2

N

National Rubber Co. 93
Newark Stamping & Foundry Co. 111
New Departure Mfg. Co. 100
New Process Gear Corporation 104
Norma Co. of America 3
N. J. Car Spring & Rubber Co. 103
N. Y. & N. J. Lubricant Co. 105

P

Park Drop Forge Co. 105
Perlman Rim Corp. 103
Pfau Mfg. Co. 94
Pittsfield Spark Coil Co. 92
Prest-O-Lite Co. 105

R

Rajah Auto Supply Co. 104
R. & H. Platinum Works 100
Russell Motor Axle Co. 104

S

Salisbury Wheel & Mfg. Co. 105
Sheldon Axle & Spring Co. 82
Simms Magneto Co. 96
Splitdorf Electrical Co. 97
Spring Nut Lock Company 99
Steel Products Co. 64
Stewart-Warner Corp. .... 2nd Cover
Stromberg Motor Devices Co. 103
Studebaker Corp. 4

U

United Alloy Steel Corp. 61
United Smelting & Aluminum Co. 113
Universal Rim Co. 86-87
U. S. Ball Bearing Co. 84, 85

V

Velie Motor Vehicle Co. 47

W

Ward Leonard Electric Co. 105
Waukesha Motor Co. 103
Webber & Co., Phil H. 101
Weston Electrical Instrument Co. 104
Whitney Mfg. Co. 112
Willys-Overland Co. .... Back Cover
Winkley Co. 102

Z

Zenith Carburetor Co. .... 3rd Cover

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PURE INGOTS
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USE ELEKTRA ITS THE SAFEST BRAKE LINING

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ON THE STEEPEST HILL
IT'S A FRIEND INDEED

Good brakes? Certainly you need them! But brakes without the safest brake lining are like a car without tires—next to useless.

Don't use "any old" facing for your brakes. It's not good policy—to say nothing about the safety of your own life and the lives of your passengers.

Get ELEKTRA BRAKE LINING. It's the safest—whether you're going down Devil's Gulch or up Jacob's ladder, ELEKTRA is made of selected asbestos chemically combined with an indestructible metal. It gives splendid wear and long service.

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Write for it—today.

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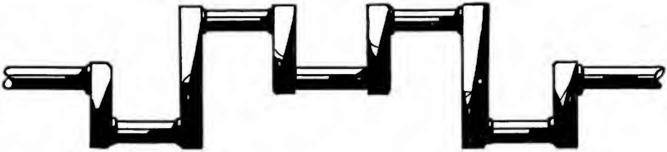

The Crank Shaft of an Automobile

is a very important part of the machine. If it breaks there is lots of trouble for the owner—and less sales for the manufacturer.

Manufacturers who wish to ensure themselves against the breakage of *crankshafts, drive shafts, axles, connecting rods, transmission gears,* etc., are making these parts of "AGATHON" STEELS—and that's why their machines are meeting with great success.

"AGATHON" STEELS are produced in one of the most modern and up-to-the-minute steel plants in the world, every step in the numerous processes being overseen by highly efficient specialists.

It will pay YOU to give "AGATHON" a trial.

AGATHON STEELS

"AGATHON" Special Analyses
"AGATHON" Vanadium
"AGATHON" High Carbon
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MASSILLON, OHIO

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Supervision limits the value of the man. The less of it he requires, the more he is worth. Employers recognize this truth and reward their men accordingly. There is a constant demand for faithful workers who do not require watching.

Apply this rule of business when selecting your important car units. The carburetor which gives the most consistent service with the least thought or attention is—like the dependable employee—the most profitable, the most satisfactory, the best business proposition. They both work with steady uniformity, needing no urging nor assistance.

The Plain Tube Zenith Carburetor is in this class of faithful workers. Because of its simplicity of design and fixed adjustments, it cannot wear or be thrown out of tune by inquisitive fingers. It gives maximum results at all times, and is a money-saver in gasoline and service charges.

This is the type of carburetor you can employ to the best advantage. It is a business proposition which many leading manufacturers have adopted. Try Zenith and enjoy immunity from carburetor troubles.

ZENITH CARBURETOR CO.

NEW YORK DETROIT, U. S. A. CHICAGO

Willys Knight

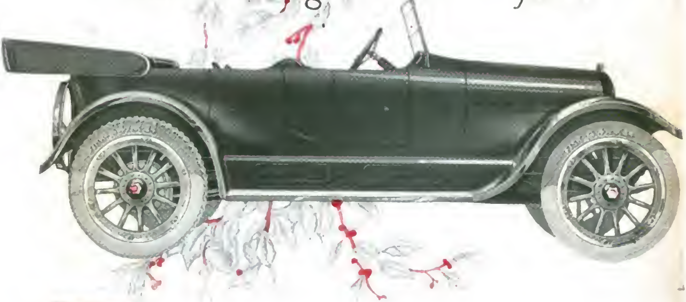
Sleeve-Valve Motor

Seven Passenger

Model 88-4

$1285

f o b Toledo



The best fine car buy in the world today

These big, beautiful, seven passenger Willys-Knights are the best fine car buy in the world.

They have every up-to-the-minute advantage of style, equipment and finish plus a motor which is superior to any other type of motor in the world.

The sleeve-valve motor gets better and better right along.

It gets steadily smoother and quieter.

It will actually serve you day in and day out, with less interruption than any other type of motor in the world.

The very carbon deposits that ruin most motors actually improve the Willys-Knight.

As carbon collects in the Willys-Knight motor it simply forms a smooth-as-glass coating, which is rubbed and polished by the sliding mechanism until it makes a perfect surface.

And as to grinding valves—this motor has no valves in the sense that other motors have.

Instead of valves, that must be knocked open by cams and slammed shut by springs, the Willys-Knight simply has openings or vents in its sleeves.

When these openings of the outer and inner sleeves come into register the gas has free passage.

And instead of eight separate valve mechanisms to be kept in perfect adjustment, there is just one positive valve mechanism in the Willys-Knight motor which can't possibly vary.

Of course there is virtually no wear in such valve mechanism.

The sleeve-valve motor is mechanically superior in design and operation.

And you will want the new Willys-Knight as much for its superior beauty and comfort as for its superior motor.

See the Overland Dealer now.

The Willys-Overland Company, Toledo, Ohio

"Made in U. S. A."

SEP 17 1938
B

The AUTOMOBILE

Vol. XXXV
No. 23

NEW YORK, DECEMBER 7, 1916

Ten cents a copy
Three dollars a year

Maud L'Anphere Crook

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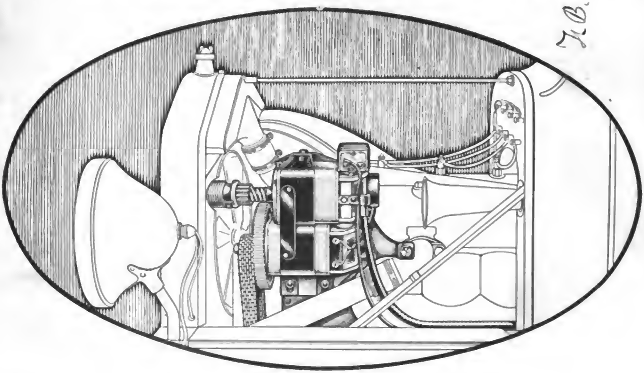
GD

GRAY & DAVIS
STARTER for every FORD



The car owners' recognition of permanent reliability in Gray & Davis Starters gives prestige and confidence to dealers who handle Gray & Davis systems.

GRAY & DAVIS, Inc., Boston, Mass.

Stewart Products

Stewart Speedometer for Fords
$10

Stewart Motor Driven Warning Signals
$6

Stewart Tire Pump
$12

Stewart Hand Operated Warning Signal
$3.50

Winter Business Leaders

Stewart Products are the leaders all the year 'round. They are 365-day-in-the-year sellers—sold 52 weeks running—straight through 12 months.

Stewart Products know no seasons—motorists *need* and *buy* them in winter and summer.

For example, there is the Stewart-Warning Signal—an absolute necessity for winter driving. In winter motorists are driving, all muffled up in heavy clothing, side curtains up, or with a winter top. Oftentimes the vision is obscured by snow and sleet. Then, the efficient, far-sounding Stewart Warning Signal is the only safe-guard.

Dealers can sell every motorist a Stewart Warning Signal by merely pointing out how necessary it is.

And the other Stewart Products—the Speedometer, Vacuum System, Tire Pump, Spark Plug—are all just as necessary in winter.

Live dealers will do a *big* Winter Business with Stewart Products.

Stewart
PRODUCTS
PRESTIGE
QUALITY
SERVICE
SATISFACTION
USA

STEWART-WARNER
SPEEDOMETER CORP.
Chicago, U. S. A.

Stewart Speedometer
$25

Stewart V-Ray Spark Plug
$1

Warner Auto-Meter
$50

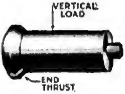
Stewart Vacuum System
$10

BOWER SAVES POWER

On a Straight Road

or Round a Corner

Bower Roller Bearings meet every stress—vertical load and end thrust—in the most efficient manner. The rollers are of maximum diameter, and being self-aligning, never need adjustment.



BOWER

ROLLER BEARING CO.
Detroit Michigan

Double Row

In the development of the Electric vehicle

one of the great problems that arose was that of overcoming the friction and wear of motor bearings and the troubles that naturally followed throughout the power producing and transmitting elements.

November 1, 1916 *THE COMMERCIAL VEHICLE* 49

Electric Truck Troubles and Means Taken to Eliminate Them

PAPER READ BY F. E. WHITNEY AT CONVENTION OF THE ELECTRIC VEHICLE SECTION, N. E. L. A. AT CHICAGO LAST MAY

"Motors.—The earlier motors were patterned directly from the street railway motors in use at that time, but, due to the more exacting requirements on account of small gearing and closer limits required, considerable difficulty was experienced with the motors with plain bearings lubricated with grease boxes. The trouble was principally felt on gear-driven trucks, which were in vogue at that time. The wear of the bearings would allow the gears to separate far enough to cause rapid wear and frequent breakage, with the consequent trouble of teeth breaking off and lodging between the gears, bending shafts and doing other damage. With the adoption of ball bearings these troubles were eliminated.

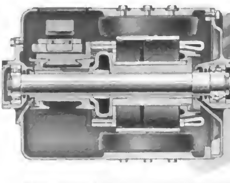
Single Row

In the progress towards perfection, the use of

NEW DEPARTURE BALL BEARINGS

American Made for American Trade

has demonstrated the wisdom of the builders who first installed them and of the multitude of those who, following the lead of the pioneers in the industry, have since installed New Departures in a constantly growing majority of American made electrics.



Sectional View of Electric Vehicle Motor Showing Ball Bearings for Armature Support

Showing Ball Bearing in Place in Motor Housing

THE NEW DEPARTURE MANUFACTURING COMPANY

BRISTOL, CONN., U. S. A.

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231-241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, DECEMBER 7, 1916 No. 23

Important Trade News of the Week.........949-959

Editorials 960

Ignition Is Much Improved.....................961

Few Changes in Magnetos.....................967

Spark Type Affects Power.....................970

Goodyear Cord Tires Easy to Repair...........971

The Engineers' Forum..........................972

A Car Unloading Platform.....................973

Studebaker Continues Four and Six............974

New White Four Has Sixteen Valves...........978

Clutch Drives in Allen Axle...................980

Elegance in New Dodge Convertible Sedan......981

Four-Cylinder Best Tractor Engine............982

Dolly Madison Four-Passenger Roadster........983

Should Study Car Balance.....................984

The Rostrum..................................985

Cannot Change Steamer to Gas Car
Avoid Stopping on Main Highways
Removing Tar from Car Bodies

Accessories 987

Industrial Miscellany..........................989

Automobile Calendar...........................989

INDEX TO ADVERTISERS......116-117

NORMA

In the world of electrical accessories, "NORMA" stands for bearing service. Therefore, when you adopt "NORMA"-equipped magnetos, lighting generators and starting motors, you will introduce into your equipment an element of dependability that will add to the serviceability and saleability of your product.

Are Your
Electrical
Accessories
"NORMA"
Equipped?

THE NORMA COMPANY OF AMERICA
1790 BROADWAY NEW YORK
Ball, Roller, Thrust, Combination Bearings

The Sign of Mechanical Excellence the World Over

The Sign of Mechanical Excellence the World Over

What Governs a Buyer's Choice of Cars

HERE are the factors—aside from price—which largely rule a buyer's choice of motor cars:

Fancy is one. And by this we mean that a buyer may take a fancy to a certain car because of its looks, or its action, or for reasons he can't explain. One man has a liking for one necktie, a second for another. And neither, perhaps, can tell why.

Then there is *Intellect*. That governs many a buyer. Men who *think* investigate before they buy—not only the car, but also the standing of the maker.

The Case "Forty" is a car that appeals to *both* Fancy *and* Intellect.

Its distinguished appearance—high hood, long sweeping lines, roominess, grain leather upholstery and rich finish—these graces make Case win instant favor with buyers.

YET the Case is only $1190, and there's not another car near it in price that can stand comparison in Beauty and Luxury.

Then to the Intellect this great Forty suggests: "Here is a powerful motor built by Case—the builder of millions of dollars' worth of power machinery. I take no chances if I buy this car—I need not rely on any man's word for that. I can safely depend on Case reputation and Case responsibility."

The Public *accepts*—without need of persuasion—these vital considerations. That's why, as dealers frankly tell us, the Case is sold with far less effort than any other car they've handled.

If this handsome Case "Forty" is not now represented in your vicinity, write us to tell you what we have in store for new dealers. At present we have a few more dealership opportunities to offer in certain territories. You'll find our proposition most attractive. Write today.

J. I. CASE T. M. COMPANY, Inc., 131 Liberty St., Racine, Wis.

FOUNDED 1842

([illegible])

CASE

THE AUTOMOBILE

VOL. XXXV NEW YORK, THURSDAY, DECEMBER 7, 1916—CHICAGO NO. 23

Any State May Tax Non-Residents

N. J. Motor Laws Upheld by U. S. Supreme Court in Case Against F. J. Kane

WASHINGTON, D. C., Dec. 4—The United States Supreme Court in a decision to-day established the right of any State to tax non-resident automobile owners for the use of their roads. The decision is of national import in that it lays the way open to changes in the laws of those States which should decide to take advantage of to-day's ruling.

According to the decision, a State may impose a tax on the use of non-resident automobiles, rather than upon the machines themselves, to compensate for the wear and tear on highways.

The decision was the result of the arrest of F. J. Kane of New York for operating an automobile in New Jersey without registering his car there. The case was based on the violation of three provisions of the New Jersey law; first that Kane had failed to register his car in New Jersey; second, that he failed to pay the tax imposed on non-residents; and third, that he failed to file with the Secretary of State a power of attorney. The last provision was to enable residents who had suffered injury at the hands of non-resident motorists, to prosecute their claims for redress in that State instead of being compelled to follow the non-resident to his home State, wherever that might be.

Both New Jersey and Maryland impose a graduated license tax, on both residents and non-residents, based upon horsepower. In January, 1915, the Supreme Court upheld the Maryland statute as not burdensome on interstate commerce, but in the New Jersey case the contention was made that the taxes were not solely for adminstration costs of regulation and registration of automobile traffic, as was the case in Maryland.

The law in question is that of 1906, as amended in 1908 and known as the Freylinghuysen law, which has been since considerably modified. Though New Jersey has, since the litigation started, adopted reciprocal legislation as to visiting motorists, the decision, really a test case, may change the laws of the States, even going so far as to nullify all reciprocal relations between the various States.

Charles Thaddeus Terry, well known New York lawyer, who has been an able exponent of rational automobile legislation in the East, claims that this decision, relating to non-resident registration only, does not affect the greater argument as to whether a resident motorist should be required to pay a tax greater than the bare cost of registration. This question has yet to be settled.

Collins Is Chevrolet Sales Manager

NEW YORK., Dec. 1—J. S. Collins has become sales manager of the Chevrolet Motor Co. of Michigan, with headquarters at the Flint factory. Mr. Collins succeeds F. K. Lane, resigned, and will have charge of the territory embracing the states of Michigan, Indiana and Ohio and portions of Wisconsin, Illinois, Kentucky, West Virginia, Pennsylvania and New York.

He spent 13 years with the International Harvester Co., passing through several promotions and reaching the post of assistant general agent at Jackson.

Promotions at Chalmers

DETROIT, Dec. 4—E. C. Morse, vice-president in charge of the sales for the Chalmers Motor Corp., has been appointed general manager of the company. W. P. Kiser, treasurer, has been promoted to secretary and assistant general manager. D. T. Turnbull succeeds Mr. Kiser as treasurer.

White Four Has 16 Valves

Plain-Bearing Crankshaft, Unit Power Plant and Center Brake Lever Features

CLEVELAND, Dec. 4.—Summing up engine performance as a matter of valve efficiency, the engineering department of the White Motor Co., Cleveland, has evolved and is just about to start production on a sixteen-valve four. Accompanying the new model there are a number of other innovations on the chassis which are notable departures from previous White practice.

This is the first White unit power plant, and it incorporates a plain bearing crankshaft instead of the ball-bearing design which is continued on the other models. The cylinders have removable heads, the oil is carried in the lower part of the aluminum crankcase instead of in a dash reservoir, and the entire appearance of the unit does not resemble previous products in any way.

Many Refinements

All through the chassis are a number of alterations which mark advancement in design. There is a cane type of gearshift lever, with a standard gate instead of the cross-over shifting arrangement formerly employed. The brake lever is in the center instead of at the left side, allowing a clear passageway through the left front door. The springs are semi-elliptic and the spare tires, instead of being carried in a well on the running board, are now supported on a bracket at the rear. In fact, a score or more of altered details can be located at a glance.

Most of the interest in the new car is focussed on the power plant. Here the lessons learned on the race track

(*Continued on page* 978)

Five Car Companies Raise Prices

Winton, Mitchell, Saxon, Allen and Premier Announce Revised Lists

CLEVELAND, Dec. 4.—The Winton Co. will increase the price of all its models by $200. The raise becomes effective Dec. 15.

Mitchell Increases Prices $100

RACINE, WIS., Dec. 1—The Mitchell Motors Co., this city, increased to-day the price of the Mitchell and the Mitchell Junior $100.

Saxon Six Price Now $865

DETROIT, Dec. 5—The price of the Saxon six has been increased from $815 to $865, due to the increased cost of labor and materials. The raise takes effect Jan. 1.

Premier Raises Car Prices

INDIANAPOLIS, IND., Dec. 1—The Premier Motor Corp., this city, has raised its prices on the seven-passenger touring car and four-passenger roadster from $1,685 to $1,895, on the limousine and town car from $2,950 to $3,150, and on the sedan from $2,685 to $2,900.

Allen Raises Closed-Car Prices

FOSTORIA, OHIO, Dec. 5—The Allen Motor Co. will increase the price of its coupé and sedan $100, effective Jan. 1. The new price for the coupé is $1,175 and for the sedan $1,195.

Perry Again in America

DETROIT, Dec. 2—P. L. D. Perry, president of the Ford Automobile Co. of Great Britain, is again in this country, following a recent trip to England. Mr. Perry states that the British government has issued orders to automobile makers which prohibit them from manufacturing cars for private persons except under special license.

De Lorenzi Sails for England

JACKSON, MICH., Dec. 1—E. A. De Lorenzi, service engineer of the Briscoe Motor Corp., has sailed for England to enter the transportation department of the Allies.

Chase Joins S. A. E. Office Staff

NEW YORK, Dec. 5—Herbert Chase has joined the office staff of the Society of Automobile Engineers. He was formerly connected with the Automobile Club of America as laboratory engineer and chief engineer. His new capacity will be that of assistant secretary. He is at present treasurer of the society and a member of its council, and has taken a prominent part in the activities and conduct of the Metropolitan Section.

His preparatory engineering education was had at the Pratt Institute. He was graduated as a mechanical engineer at Sibley College, Cornell University, in 1908.

Duryea Forms $4,000,000 Company to Build $250 Car

WILKES-BARRE, PA., Dec. 5—The Duryea Motors, Inc., of which Charles E. Duryea is president, has been formed with a capital of $4,000,000 to build the Duryea Gem at $250. This car will seat three persons. Other features include the Duryea patented roller drive.

Negotiations have been closed for a factory site and the Cutlery Works plant in the southern part of the city has been leased to start manufacturing.

Plans are to open the factory in the immediate future, just as soon as 20,000 shares of the stock, par value $5, is bought by the people of this city.

Dennet Resigns from Packard

DETROIT, Dec. 1—M. S. Dennet, chief inspector of the Packard Motor Car Co., has resigned. Mr. Dennet will represent the Muskegon Motor Specialties Co. and the Ajax Forge Co. in Detroit.

Reo Earnings Total $4,031,070

Assets of Car and Truck Cost $11,978,307.98—Surplus $3,849,828.20

LANSING, MICH., Dec. 1—The net earnings of the Reo Motor Car Co. and the Reo Motor Truck Co. for the year ending Aug. 31, 1916, were $4,031,070.26. Current assets were reported as amounting to $7,610,501, with a surplus of $3,849,828.20. Total assets are $11,978,307.98, capital assets amount to $4,277,674.06, and current liabilities are $1,191,229.78. This strong financial position is stated in a balance sheet at the close of business, Aug. 31, 1916.

The current assets show an increase of $2,776,845.36, as compared with the current assets of $4,833,655.75 on Aug. 31, 1915. Other important items mentioned in the report are certificates of deposit of $320,000, cash on hand in banks $1,360,517.97 and inventories of finished product, supplies and materials on hand amounting to $4,904,511.23.

It is thought, among some of the stockholders, that the company's annual meeting on Dec. 19 will witness a large stock dividend distribution, because of the large residue of unissued stock and surplus. The balance sheet follows:

ASSETS			
Current assets			$7,610,501.11
Cash on hand and in banks		$1,360,517.97	
Certificates of deposit		320,000.00	
Receivables		1,025,471.91	
Notes receivable	$121,162.06		
Accounts receivable	546,077.28		
Drafts outstanding	421,320.05		
Accrued interest	3,009.16		
	$1,091,768.49		
Less reserves	66,296.58		
	$1,025,471.91		
Inventories		4,904,511.23	
		$7,610,501.11	
Capital assets			4,277,674.06
Land		$235,999.92	
Buildings		1,136,458.34	
Machinery and equipment		2,905,215.80	
		$4,277,674.06	
Deferred charges			16,345.31
Interest in other corporations			73,787.50
			$11,978,307.98
LIABILITIES			
Current liabilities			$1,191,229.78
Accounts payable		$1,025,313.68	
Accrued pay roll		82,416.10	
Reserve for taxes		78,500.00	
Other reserves		5,000.00	
		$1,191,229.78	
Capital			10,787,078.20
Capital stock authorized		$11,000,000.00*	
Less unissued		4,062,750.00	
Stock outstanding		$6,937,250.00	
Surplus		3,849,828.20	
		$10,787,078.20	
			$11,978,307.98

---

*This amount includes the Authorized Capital Stock of both Car and Truck Cos. The purchase of the Truck Co. by the Car Co. eliminated the Truck Co. Stock. Authorized Capital Stock is now that of the Reo Motor Car Co., $10,000,000.00 and Unissued $3,062,750.00.

Overland Men Take 25,925 Cars

2237 Dealers and Guests at Convention Inspect 1917 Models and Plant

TOLEDO, Dec. 6—Willys-Overland dealers closed contracts for 25,925 cars, aggregating more than $20,000,000 in value, during the first 2 days of their annual convention at the factory of the Willys-Overland Co., this city. The new Country Club model proved most popular with the thirty-eight distributors from seventeen States. Dealers and guests numbering 1027 arrived to-day from all parts of the country, bringing the total attendance to date up to 2237.

Anderson and Young Promoted

DETROIT, Dec. 6—Lee Anderson has been appointed vice-president of the commercial division of the Hupp Motor Car Corp., this city, Dubois Young has been appointed vice-president of the manufacturing division of the company. Mr. Anderson, who has been with the company for 2 years, was formerly advertising and commercial manager.

N. A. C. C. Export Conference in January —Nov. Shipments 17,250 Carloads

NEW YORK, Dec. 6—Directors of the National Automobile Chamber of Commerce at their meeting to-day voted to hold a meeting in January of the export managers of the companies holding membership in the organization. Exports have been increasing every year and the figures for 1916 will exceed $160,000,000.

Notwithstanding the shortage in freight cars, which has seriously affected the industry, shipments of automobiles for November were 17,250 carloads as against 17,138 for the same month last year. Report was made at the investigation of the Interstate Commerce Commission regarding the rules and practices of railroads taking interchange of cars, and it was clearly shown that this service has been seriously impaired by the cars being arbitrarily used in other services. It was also reported that a committee of presidents of the American Railway Assn. had agreed to establish at Washington a conference committee on car efficiency, consisting of five operating officials to co-operate with the Interstate Commerce Commission in an effort to relieve the freight car shortage.

It is expected that the railroads will soon advance their per diem charge for the use of freight cars by other roads from 45 cents to $1.00 or $1.25 per day.

Charles Clifton, president of the N. A. C. C., gave his annual complimentary dinner to the directors at the Hotel Biltmore last night.

Tener Maxwell Sales Director

DETROIT, Dec. 5—T. J. Tener has become director of sales of the Maxwell Motor Co. He was formerly Pacific Coast zone manager. C. E. Zebbins, formerly sales manager, is now assistant director of sales. Charles Gould, formerly service manager, is now sales manager. G. S. Gamble has been appointed assistant sales manager.

Herschell-Spillman Capital Tripled

NORTH TONAWANDA, N. Y., Dec. 1—The Herschell-Spillman Co., this city, will increase its capital stock on Jan. 1, 1917, from $250,000 to $750,000.

This increase in stock is made necessary in order to provide facilities to take care of the company's increase in business during the past year.

France Heavy Buyer in October

Leads European Countries in Purchase of Cars—United Kingdom Heads List

WASHINGTON, D. C., Dec. 2—Among European countries France was the heaviest buyer of American automobiles in October last, according to export figures compiled by the Department of Commerce. Five hundred and twenty-two cars, valued at $1,782,088, were shipped there during that month. During the corresponding month of last year France imported 298 cars, valued at $912,139, from this country. During the 10 months ended October the shipments of cars to France increased from 5183, valued at $13,038,767, in 1915, to a total of 7019 cars, valued at $18,311,143, in 1916.

United Kingdom Purchases Decline

Exports of cars to the United Kingdom amounted to 684 machines, valued at $1,687,152, in October last, as against 2021 cars, valued at $2,730,468, in October a year ago. There was a big falling off in the exports during the 10 months' period, the shipments declining from 21,455 cars, valued at $31,379,217, in 1915, to 7959 cars, valued at $13,763,990 in 1916, a result of war conditions and rulings.

Russia's Gain

Russia did not figure in the export returns last year, but during October last that country imported 116 cars, valued at $287,590, while during the 10 months of this year the imports amounted to 2968 cars, valued at $8,199,-

(*Continued on page 959*)

Exports of Automobiles, Trucks and Parts for October and 10 Previous Months

	October							
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	3,479	$2,749,255	4,880	$3,756,768	34,515	$29,543,227	51,699	$36,049,497
Commercial cars	1,596	4,307,190	1,144	3,635,291	18,865	52,076,406	15,917	44,006,346
Parts, not including engines and tires	....	1,819,950	....	1,949,060	.....	12,814,809	.....	20,091,793
	5,075	$8,876,395	6,024	$9,341,119	53,380	$94,434,432	67,616	$100,147,636
			By Countries					
Denmark	....	....	342	$241,020	.....	....	1,305	$955,432
France	298	$912,139	522	1,782,088	5,183	$13,038,767	7,019	18,311,143
Germany	....	....	....	....	4	2,800	.....	....
Italy	40	25,887	7	7,517	210	134,901	244	151,484
Russia	....	....	116	287,590	.....	....	2,968	8,199,997
United Kingdom	2,021	2,730,468	684	1,687,152	21,455	31,379,217	7,959	13,763,990
Other Europe	814	1,920,176	301	327,196	7,502	20,003,140	3,403	4,194,615
Canada	189	202,552	1,021	718,962	5,238	4,154,137	11,118	8,025,079
Mexico	13	12,250	129	94,089	88	84,141	539	467,976
West Indies and Bermuda	267	173,355	665	505,198	2,625	1,478,360	4,704	3,152,389
South America	383	210,840	....	....	2,464	1,277,326	.....	....
Argentina	....	....	302	195,512	.....	....	4,258	2,206,709
Brazil	....	....	44	33,046	.....	....	348	232,860
Chile	....	....	195	158,719	.....	....	1,075	712,748
Venezuela	....	....	36	23,781	.....	....	447	284,316
Other South America	....	....	113	64,986	.....	....	816	509,877
British East Indies	....	....	329	223,543	.....	....	3,430	2,507,789
Australia	....	....	347	274,073	.....	....	7,025	5,361,054
British Oceania	447	360,260	....	....	3,594	3,041,852	.....	....
Asia and other Oceania	295	284,063	595	554,648	3,245	5,474,001	7,402	8,550,494
Other countries	308	224,455	276	212,939	1,772	1,550,991	3,556	2,467,891
	5,075	$7,056,445	6,024	$7,392,059	53,380	$81,619,633	67,616	$80,055,843

$10,000,000 in Cars Held Up

Makers May Suspend Manufacturing if Relief Is Not Forthcoming

DETROIT, Dec. 2—More than $10,000,000 worth of automobiles are held up awaiting freight cars for shipment. Many automobile makers will be forced to suspend manufacture if relief is not immediately forthcoming. These were statements made yesterday at a meeting of the traffic committee of the National Automobile Chamber of Commerce held in Detroit.

The committee named two committees who will visit railroad officials throughout the Central Freight Association territory and in the East to urge compliance with the Interstate Commerce Commission's recommendation that automobile cars be returned promptly to their home lines.

Traffic men named on the committees include H. R. Moule of the Chalmers Motor Car Co., A. C. Westfall of the Cadillac Motor Car Co., C. W. Eggers of the Willys-Overland Co., J. R. Graham of the Reo Motor Car Co., H. M. Newlin of the Maxwell Motor Co. Mr. Eggers is chairman of the traffic committee.

"There are approximately 30,000 automobile freight cars in the Central Freight Association territory and on Eastern trunk lines that are being used for all kinds of shipments other than automobiles," stated Mr. Eggers, following yesterday's meeting, "and we shall try to obtain the return of these cars. We shall point out to the railroad officials the recommendation made by the Interstate Commerce Commission in connection with its order calling for a redistribution of freight cars, to the effect that automobile cars should be returned to their home lines. Unless we can get some action in this matter it is probable that many car factories will have to suspend operations for a time at least."

Freight Car Shortage Necessitates Urgent Relief

NEW YORK, Dec. 4—Nation-wide redistribution of box cars is required by a new order agreed upon by the railroad conference committee on car efficiency in its campaign to relieve the car shortage which is seriously holding up freight in all parts of the country. By this order box cars will be diverted from parts of the country where they are not needed, to the West, Northwest, South and Southwest, where there is urgent need for them. The instructions issued refer to box cars, loaded or empty.

As an emergency measure the railroad authorities at Washington have authorized the railroads to establish and maintain until May 1 a new progressive demurrage scale higher than the present flat rate of $1 a day. Under the new scale 2 free days are allowed, and subsequent charges are $1 for the third, $2 for the fourth, $3 for the fifth day, and $5 for the sixth and each day thereafter.

Apropos of the redistribution plan, railroads in New England are to turn over to their Southern and Western connections 30 per cent more box cars than they receive from those lines. Railroads in what is known as the trunk line and central freight territory, regardless of the number of box cars on their lines, must deliver to their Southern and Western connections 20 per cent more box cars than received from them.

Car Shortage Felt at Flint

DETROIT, Dec. 4—The Chevrolet Motor Co. has been forced to double deck the ordinary freight cars, shipping cars in many pieces in order to load them, and putting six cars in a freight car instead of three as ordinarily, in its efforts to overcome the freight car shortage. Every automobile maker in Flint is suffering from the shortage. Incoming freight shipments are piled up at the various freight receiving sheds. Railroads are making every effort to relieve the congestion.

November Jeffery's Biggest Month

KENOSHA, WIS., Dec. 2—During the first 3 months of the Nash Motors Co. régime, all sales records have been broken. November was the biggest sales month in the history of the company. During that month, its books showed an actual increase of 381 per cent over the corresponding month last year.

Batavia Rubber Complains of Discriminating Freight Rates

WASHINGTON, Dec. 6—The Batavia Rubber Co., Batavia, N. Y., has filed complaint with the Interstate Commerce Commission charging the Atlantic Coast Line Railroad, and connecting lines, with discrimination in rates with respect to its articles of manufacture on shipments meant for so-called Southern Classification territory by way of Ohio River crossings.

The complaint alleges that this discrimination extends to classes of tires as follows:

First class, on pneumatic tires, in any quantity; second class on solid tires, any quantity; and, first class, on all others, such as tires in steel-casings.

The complainant asks the commission to order rates which will cause "a larger spread" between the carload, and less than carload lots.

Goodyear Profits $7,003,330

Sales During Company's 1916 Fiscal Year Total $63,950,399

AKRON, Dec. 6—Sales of $63,950,399.52 during the past year are reported by the Goodyear Tire & Rubber Co., this city, in the year ending Oct. 31, 1916. This compares with $36,490,651.64 for the preceding year. Net profits were $7,003,330 as against $5,189,528 for the preceding year. There remains an unappropriated surplus of $2,253,166.87. Cash dividends during the year amounted to $764,239.28 on the preferred and $1,261,332 on the common. Stock dividends amounted to $8,427,000. To meet the demand for its products, the company added more fixed capital, which was provided for by the sale of $17,500,000 of preferred, having previously retired $6,650,000 of preferred then outstanding. A stock dividend of 100 per cent out of accumulated surplus was distributed, after paying the regular cash dividends, 7 per cent on the preferred and 12 per cent on the outstanding common.

In its balance sheet the company shows total assets amounting to $49,217,794, total liabilities of $9,167,973, thus leaving an excess of assets over liabilities of $40,049,820.

Reo Drives 70 Per Cent of Cars

LANSING, MICH., Dec. 4—The Reo Motor Car Co. is driving more than 70 per cent of its output to dealers within a radius of 1000 miles in order to overcome the scarcity of freight cars, and up to the present has been fortunate enough to escape great hardship. The company plans to use flat cars when severe Winter weather prevents driving.

Post Tire Buys Plant

ST. LOUIS, Dec. 2.—The Post Tire and Rubber Corp, recently incorporated for $1,500,000, has bought the plant of the Union Tire & Rubber Co., this city, and will immediately begin operations. The plant consists of a two-story brick structure with a total floor space of 70,000 sq. ft.

Grant Moves to Cleveland

CLEVELAND, Dec. 1—The Grant Motor Car Corp. marks the opening of its fourth year of growth, by removal from Findlay, Ohio, to its great new factory at Coit and Kirby Avenues, Cleveland.

The new Grant home is a model of modern efficient factory construction and arrangement. The length is 600 ft.; the width 250 ft., and the floor space, 150,000 sq. ft. It has an annual capacity of 35,000 cars.

The factory is a unit. Every department, while separate, and distinct, is within easy access of the other departments with which its work is closely connected. The car while building passes from department to department quickly. By means of a conveyor system, the final car assembly may be completed in less than 10 min. The factory stands on a 7-acre tract.

Apperson in New Factory

KOKOMO, IND., Dec. 4—The Aperson Bros. Automobile Co., this city, has just finished moving into its new group of factory buildings. Its plant is modern in every respect.

Turnbull Wagon Adds Bodies

DEFIANCE, OHIO, Dec. 4.—The Turnbull Wagon Co. has added an automobile body department. This will be operated independently of the wagon factory.

Dorris Discontinues 1500-Pounder

ST. LOUIS, MO., Dec. 1—The Dorris Motor Car Co., this city, has discontinued the manufacture of its 1500-lb. delivery wagon.

Fitch, Tractor Inventor, Dead

BIG RAPIDS, MICH., Dec. 2—John H. Fitch, inventor of the four-drive tractor and president of the Four-Drive Tractor Co., Inc., Big Rapids, died Nov. 24, after a brief illness. His office is filled automatically by E. J. Jenkins, who will continue also as general manager.

Timken Co-Operative Store

Employees of Axle Company Organize to Secure Benefits of Wholesale Prices

DETROIT, MICH., Dec. 1—Employees of the Timken-Detroit Axle Co. have organized a co-operative store for the purpose of reducing the high cost of living. For the present the store benefits will be confined to married employees, but it is planned to enlarge the establishment in the near future so that any employee may participate. Married employees will, temporarily, have to be in the employ of the firm for 6 months to be eligible. Outsiders will never be allowed to make purchases in the store.

The business will be operated entirely by employees though sanctioned and furthered by the company. L. R. Judson, head of the welfare department and temporary chairman and manager of the store, originated the idea. His first step was to write a letter to each of the eligible workers, asking them if they would like to save from 7 to 8 cents a pound on coffee. The letter was sent to feel out the employees on the subject and they were given 1 day to respond. More than 250 lb. were ordered and the plan saved the employees the amount promised, thus effectually giving the scheme its needed impetus.

A temporary structure is being erected to be used for the store and a permanent one will be built later. Orders have already been filled for tea, saving 14 cents on a 50-cent brand, and on apples saving 20 cents on a regular $2 grade. Canned goods, butter, eggs, corn meal and other staples will also be sold. A large saving on everything will be effected.

The store will start with 200 employees for membership and includes in its organization L. R. Judson, chairman and manager; G. W. Veal (assistant to general manager), acting secretary and treasurer, and W. R. McKay (superintendent), E. Rutter (material superintendent), and G. E. Holmes (carpenter foreman), executive committee.

Studebaker Plans 200.000 Car Output

DETROIT, Dec. 5—The Studebaker Corp. is making plans for a production of 200,000 cars yearly and the employment of 20,000 men, with an aggregate yearly business of $100,000,000, within the next 2 years. The company employs 8000 workers at present.

Buick Builds 563 Cars Daily

FLINT, MICH., Dec. 5—The Buick Motor Co., this city, has been turning out 563 cars daily in the past 8 working days. During November, 10,430 cars were shipped and 10,700 manufactured.

Stout Plans Aeroplane Clubs

DETROIT, Dec. 4—W. B. Stout, manager of the aircraft division of the Packard Motor Car Co., plans to organize model aircraft clubs in all of the Detroit high schools. Mr. Stout organized a similar club in Chicago under the name of the Model Aero Club of Ill. The organization developed aeroplanes from models. It is planned through the new club to be organized here, to bring all of the different Detroit organizations interested in aviation together annually in competition.

Aviation Experts Gathered Together on Joy Field

This illustration is from a photograph taken at the Aviation Field owned by Henry B. Joy of Detroit. The field is located near Mt. Clemens, Mich., on the shores of Lake St. Clair. From left to right the men are as follows: W. H. Hutton; Henry B. Joy; Charles B. King; Dr. H. C. Dickinson, Bureau of Standards, Washington, D. C.; Lieut. Col. George O. Squier, Officer in Charge of Aviation; Eugene Lewis; Dr. W. Stratton, Director of Bureau of Standards; Henry Souther, Consulting Engineer United States Army; Dr. Charles F. Marvin, Chief of Weather Bureau, Washington, D. C.; Howard E. Coffin; S. D. Weldon; Lieut. W. G. Child, United States Navy; Roy D. Chapin; Dr. Charles D. Walcott, Sec. Smithsonian Institute, and Russell Huff

Is Scare Advertising Potential?

W. B. Lashar, of Weed Chain, Advances Arguments in Favor of Such Copy

NEW YORK, Dec. 1—Whether scare advertising copy is potential copy or not is a question that may be settled in the not distant future. When the National Automobile Chamber of Commerce, Inc., appointed its committee to discourage scare advertising, one of the concerns it had in mind was the American Chain Co., manufacturer of Weed anti-skid chains. Walter B. Lashar, president of this concern, has taken up the defense of scare copy on the ground that it is positive advertising rather than negative, and he believes his advertising thus performs a public service.

One of the pertinent examples cited by Mr. Lashar is that a manufacturer of fire extinguishers that have real merit, who puts out scare copy does not thus make people give up living in houses, but makes them more keen for fire-proof construction. Mr. Lashar asks the question: "Does such copy make people scoff at the dangers of fire, make them more reckless than ever, or does it bring home to the individual a vivid realization of a fire in his home and make him insist that every possible precaution be taken to prevent fires?"

Continuing his arguments in favor of scare copy, Mr. Lashar says:

"Scare copy is like any other copy; it can be good or bad or merely negative. There is only one standard by which 'scare' copy can be judged: The criterion is not what it does *to* the public but what it does *for* the public.

"If scare copy plays upon the credulity, the superstition, the helplessness, the cupidity of people, merely to coin these weaknesses into money without regard to the harm that is being done; if this copy is a lie in spirit or in fact; if it increases real suffering and misery, by dwelling upon an evil for which there is no prevention and no remedy—then it is a crime to use such copy. But scare copy that is true, that brings home to each individual a consciousness of his own personal responsibility for a real evil that is a constant menace—a reality that exacts a frightful toll in human lives and in human suffering—and points out a direct and effective remedy that ordinary intelligence can use, such scare copy is doing a great public service.

"It is true that this 'scare' copy may make a few hundred neurasthenics a little more miserable, but the real evil is in the neurasthenia, not in the copy. The logical effect of this scare copy is to make a thousand people more careful to safeguard against troubles. The measure of the worth of such copy has not its effect upon a relatively small group of people but its effect upon the public as a whole.

"The manufacturer uses scare copy because it sells his product. Selling is the most important factor in his business. A manufacturer whose selling plan makes money for himself, and at the same time is of great and definite benefit to the public, including the part of the public that does not buy his product, seems to me to be a more real philanthropist, a more valuable philanthropist than one who gives a certain sum of money for a particular work.

"The simple truth is that scare copy is the only kind that jars some of us out of our complacent self-sufficiency, our fixed habits of carelessness, our blind delusions, that we will get through somehow, our disposition to take a gambler's risks."

Mr. Lashar finishes with the following: "These are some of the reasons why we continue to use intelligent, constructive scare copy, the object of which is to make motoring safe and secure, under all road conditions, for all those who use the road, whether they travel in cars, on foot, or by horse. So long as scare copy benefits the public infinitely more than it can profit any company, such a company can afford to let any interest that feels itself antagonized by such copy fight out the issue with the public."

Moto-Meter Enjoins Heat-Ometer

NEW YORK, Dec. 1—A preliminary injunction prohibiting sale of the Heat-Ometer radiator indicator and use of the word Heat-Ometer has been granted on complaint of the Moto-Meter Co., Inc., maker of the Boyce Moto-Meter. Suit was brought against the Times Square Automobile Co., which had been selling Heat-Ometer, the Moto-Meter Co. alleging that the device infringed its product and that the use of the word Heat-Ometer infringed the trade mark Moto-Meter.

The Heat-Ometer, made by the Heat-Ometer Co., Inc., New York, consists of a diamond-shaped frame holding a glass indicator tube containing a sensitive liquid which is pink at normal temperature but turns deep purple when a dangerous degree of heat is reached. Like the Boyce Moto-Meter, the Heat-Ometer is mounted on the radiator cap. The suit was in the U. S. district court for the southern district of New York.

Ford Suit in Judge's Hands

DETROIT, Dec. 1.—The suit instituted by Dodge Bros. against the Ford Motor Co. to restrain the latter from further expansion is now in the hands of the judges, who have taken the case under advisement for an early decision.

70% of Accidents at Crossroads

Sec. of State Hugo, of N. Y., Finds Fatalities Measured by Driver's Carelessness

ALBANY, N. Y., Dec. 2—That approximately 70 per cent of fatal automobile accidents are due to careless driving at street and road intersections, according to the coroner's report, is pointed out by Secretary of State Hugo, who has made a study of the traffic conditions accompanying such accidents.

There seems to have been little difficulty where cars travel along intersecting roads of unequal importance, owing to the established custom that the car on the less important road must approach the main highway with special caution, a practice expected by those moving rapidly on the more important thoroughfare. The real difficulty arises when crossroads are of equal importance with the result that drivers approach rapidly from both directions, each considering himself entitled to the exercise of caution by the other driver. There seems to be an increase in the number of instances where misunderstandings based on reasoning of this kind leave the driver to take chances by approaching intersections at high speed. Though the law requires drivers to slow down and signal for crossroads comparatively few observe these rules, thus enhancing the risk of accident. Secretary Hugo considers that too great reliance is frequently placed by automobilists on the power of their brakes to stop their cars quickly. This is unwise, he says, because the driver may, and frequently does, misjudge his speed and other surrounding conditions.

More Care Required

Dangerous crossroads or those of congested area are usually protected by traffic police during the daytime. After these hours, however, these points present problems in accident prevention which are constantly growing more difficult with the increasing number of automobiles and other vehicles traveling these thoroughfares.

Unless some steps are taken to compel all drivers to approach crossroads of equal prominence with the greatest care, Secretary Hugo fears that accidents of this kind will become more frequent and more serious. Warning signals might provide a certain amount of protection at such points, although these are not sufficiently effective in all cases, particularly, as there is nothing to prevent deaf persons from operating cars. The only satisfactory solution of the problem is the use of care by each individual driver when approaching such intersections.

Denmark Likes U. S. A. Cars

Consul General Winslow Reports Demand for Cars and Trucks Increasing

NEW YORK, Dec. 4—The automobile business in Denmark is in a brilliant condition at the present time, according to E. D. Winslow, consul general of the United States to Denmark. Mr. Winslow has returned only recently from that country and states that the demand for cars in that country has increased to such an extent during the past 2 years that the supply is entirely inadequate. People are prosperous on account of the high prices paid for their products due to the war, and the excellent road conditions and attractive touring possibilities of the country naturally make the purchase of a car the logical sequence.

Motor trucks have never before been in as great demand in Denmark as at the present time since the unusually high prices paid for horses by the belligerant nations have induced a very large percentage of the horse owners to part with their animals. Since the labor thus lost must be made up, motor trucks are being bought in large numbers to do the work formerly performed by the horses. On the farms the use of motor tractors has increased rapidly and it is very probable that these machines will be in still greater demand in the future.

The obnoxious laws, which formerly limited automobile touring in Denmark, have either been repealed or so modified that it is now possible to travel throughout the country just as freely as in other lands.

Most Cars Represented

Most of the leading American car manufacturers are now represented in Denmark and Mr. Winslow recommends that any car or accessory maker desirous of entering the Danish field secure special agents. There are now more dealers in Denmark than ever before, about fifty being located in Copenhagen. The people have taken kindly to American cars and accessories and at the present time our manufacturers have this market almost to themselves. If the quality of the American products is maintained and the service rendered by the manufacturers' representatives is satisfactory, this market should be continued after the war.

Very little data can be secured at present in regard to automobile imports into Denmark. The only statistics available, those for the years 1912 and 1913 appearing in tabular form below are in the form of weight of cars, chassis and parts in pounds, trucks not being segregated. These statistics serve to indicate how small these imports were before the beginning of the war.

Imported Into Denmark

COMPLETE CARS

From	1913 Lb.	1912 Lb.
Germany	979,000	765,380
Great Britain	264,000	214,500
Sweden	43,780	10,340
Belgium	36,960	7,480
France	240,020	221,320
United States	201,300	115,280
Other Countries	17,820	13,420
Total	1,782,880	1,347,720

CHASSIS

From	1913 Lb.	1912 Lb.
Germany	64,680	16,720
Great Britain	7,700	11,220
Sweden	6,380	0
France	38,500	5,500
United States	1,980	3,300
Other Countries	0	3,080
Total	119,240	39,820

PARTS

From	1913 Lb.	1912 Lb.
Germany	2,420	1,540
Great Britain	440	2,860
Sweden	11,880	1,100
France	10,560	440
Austria-Hungary	0	440
Total	25,300	6,380

To Raise Fire Insurance Rates

NEW YORK, Dec. 5—Automobile fire insurance rates will advance about 10 per cent Jan. 1. The new schedule has been issued by the Eastern and New England Automobile Underwriters' Conferences. In addition to this slight advance, policies will now be written under the non-valued plan, either with or without the theft clause. Heretofore this has not been possible. Policies under the valued plan will include the theft clause as usual. No car can be insured for more than its cost to the owner.

Wants U. S. A. Ideas

LONDON, ENGLAND, Nov. 15—At the last meeting of the Institution of Automobile Engineers, Mr. A. E. Berriman of the Daimler Co., made the suggestion that endeavors should be made to obtain each session a paper from a leading American automobile engineer, giving the latest views on designs, etc., in the United States. This was in discussion following the reading of a paper on American lighting, starting and ignition systems.

Cadillac Co. Starts Suit

DETROIT, Dec. 1—The Cadillac Motor Car Co. has started suit against the Cadillac Auto Truck Co., Cadillac, Mich., asking for an injunction restraining the latter firm from using the name Cadillac or Cadillac Auto Truck Co. or any other name prejudicial to the interests of the Detroit concern.

Electro-Pneumatic Gearshift

New Company To Erect Plant in Pittsburgh for Its Manufacture

PITTSBURGH, Dec. 4—The Electro-Pneumatic Gearshift Corp., of this city, has announced its intention to erect a plant for the manufacture of an electro-pneumatic gearshift. The actual power for shifting the gears is supplied by compressed air and contained in a reservoir and fed by a pump driven off the timing gears, there being an automatic valve for cutting in the pump when pressure falls below a predetermined amount. The air is used also for operating the clutch so that all the driver has to do is to move the switch lever mounted on the steering column.

It is stated that the magnetic operation of the valves controlling the air is such that the gears and clutch can be operated at any speed desired. This should eliminate the shock which would be bound to occur if the clutch were engaged automatically always at the same speed. It allows for smooth starting and it also enables the driver to differentiate between a change up and a change down on the gears, operations which should not be performed with quite the same celerity.

The inventor is John J. MacPherson and the company has been formed with M. F. Metcalf president and Joseph C. Baird, secretary and treasurer.

$10,000 for Fuel Research

NEW YORK, Dec. 1—A $10,000 prize for fuel research will be given by the Aero Club. By the will of the late S. H. Valentine, formerly Governor of the Aero Club of America, this sum has been given to the club to establish a prize, or prizes, for the encouragement of aircraft, which shall not use gasoline as a fuel. Mr. Valentine's bequest is expected to stimulate interest in the discovery of a new fuel, lighter than gasoline, which will make longer flights possible.

Richardson Chalmers Advertising Mgr.

DETROIT, Dec. 6—C. S. Richardson has been appointed advertising manager of the Chalmers Motor Co., this city. He was formerly with the Mahin Advertising Agency.

Travers Nash Advertising Mgr.

DETROIT, Dec. 6—E. J. Travers has become advertising manager of the Nash Motor Co., Kenosha, Wis. He was formerly with the Chicago *Herald*.

Winton Chauffeurs Get Prizes

25 Drivers Total 290,426.7 Miles at Repair Cost of $5.90

CLEVELAND, Dec. 6—The Winton Co., this city, has awarded chauffeurs $3,500 in prizes in its annual contest for those who drive Winton cars the farthest with the least repair expense. This year twenty-five chauffeurs drove their cars a total of 290,426.7 miles at a total repair expense of $5.90. George Felt of Minneapolis, chauffeur for H. D. McCord, won first prize, $500. W. C. Ball of Kalamazoo, chauffeur for F. F. Rowe, was awarded second money, $400. Alfred Shibley of Pittsburgh, driving for J. W. Lloyd, and W. M. Newsome of Atlanta, driving for M. R. Hirsch, won third and fourth prizes, respectively, $300 and $200. Prizes of $100 were awarded to the following:

A. H. Klein, chauffeur; S. J. Wilkins, Chicago, owner of car.

Ralph H. Lee, chauffeur; S. J. Franklin, Millville, N. J., owner of car.

G. M. Lewis, chauffeur; E. R. Caldwell, owner of car.

Henry Belanger, chauffeur; Mrs. D. B. Curtis, Manchester, N. H., owner of car.

George T. Macone, chauffeur; F. E. Courseen, Stockbridge, Mass., owner of car.

Thomas Murren, chauffeur; J. M. Anderson, Boston, owner of car.

Joseph Castellucci, chauffeur; Mrs. M. E. Bearse, West Medford, Mass., owner of car.

Edw. M. Armstrong, chauffeur; C. M. Godnow, Boston, owner of car.

Robert Clements, chauffeur; F. H. Jones, Andover, Mass., owner of car.

P. O. Hale, chauffeur; A. P. Friend, West Newton, Mass., owner of car.

F. H. Coyston, chauffeur; W. L. Porter, Pittsburgh, owner of car.

T. L. Quigley, chauffeur; J. J. Flanagan, Elmira, N. Y., owner of car.

Herbert Lewis, chauffeur; George Spottiswoode, Orange, N. J., owner of car.

Chris McDermott, chauffeur; Robert Fraser, Utica, N. Y., owner of car.

P. J. Farrington, chauffeur; M. H. Hellman, Los Angeles, owner of car.

Charles Schmidt, chauffeur; Thomas Lonergan, St. Louis, owner of car.

W. Desillier, chauffeur; Allen Arnold, Swampscott, Mass., owner of car.

W. L. Woods, chauffeur; Miss H. J. Silver, Brooklyn, owner of car.

A. P. Holst, chauffeur; Mrs. John Sexton, Chicago, owner of car.

E. P. Carey, chauffeur; William de la Barre, Minneapolis, owner of car.

Albert Hitchen, chauffeur; C. W. Tabor, Los Angeles, owner of car.

More interesting than the report for any single year are the grand totals for the entire period during which contests have been conducted—9 years, as follows:

Number of cars that traveled 5000 miles or more each	536
Total mileage made by these cars	5,509,049.3
Average miles per car	10,278
Total repair expenses for all cars	$5,640.61
Average repair expense per car	$10.52
Average repair expenses per car per 1000 miles	$1.03

Or less than 1-9th of 1 cent per mile.

The total distance traveled by these Winton Six cars, every mile of which was sworn to by both the car owner and his chauffeur, is greater than would be traveled on 220 tours around the earth at the equator. Five and one-half million miles certainly constitute an exhaustive test of the standing-up qualities of a motor car. And the average repair expense indicates that a Winton six owner traveling 25,000 miles per year would encounter repair expenses of $25.75 per annum.

Detroit-Wyandotte Sells Stock

DETROIT, Dec. 1—The Detroit-Wyandotte Motor Truck Co. is selling its unissued treasury stock for the purpose of securing a larger working capital. The concern is going into foreign markets and is making shipments to Porto Rico and Cuba.

Steel Prices Higher

NEW YORK, Dec. 5—This week's market activities were featured by the expected rise in steel. Both Bessemer and open-hearth rose $2.50 a ton to $55. Lead rose 45 cents per 100 lb. to $7.75. Kansas crude petroleum went up 10 cents a barrel on Thursday to $1. Rubber prices are higher. Para quoting at 79 cents a pound and Ceylon at 74½ cents.

The further rise of rubber will probably hasten the long-expected rise in tire prices, which, it has been reported, will probably go up in the early part of 1917.

Tin dropped to $45 per 100 lb., a net loss of 25 cents. Rapeseed oil rose 3 cents to 98 cents a gallon. Linseed oil dropped 3 cents a gallon to 93 cents.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.63	.63	.63	.63	.63	.63	...
Antimony, lb	.14	.14	.14	.14	.14	.14	...
Beams and Channels, 100 lb.	3.17	3.17	3.17	3.17	3.17	3.17	...
Bessemer Steel, ton	52.50	52.50	52.50	55.00	55.00	55.00	+2.50
Copper, Elec., lb.	.35	.35	.35	.35	.35	.35	...
Copper, Lake, lb.	.35	.35	.35	.35	.35	.35	...
Cottonseed Oil, bbl.	12.77	12.75	12.71	12.75	12.73	12.70	— .07
Fish Oil, Menhaden, Brown, gal.	.68	.68	.68	.68	.68	.68	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb.	7.30	7.40	7.40	7.50	7.50	7.75	+ .45
Linseed Oil, gal.	.96	.96	.96	.96	.93	.93	— .03
Open-Hearth Steel, ton	52.50	52.50	52.50	55.00	55.00	55.00	+2.50
Petroleum, bbl., Kans., crude	.90	.90	1.00	1.00	1.00	1.00	+ .10
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.98	.98	.98	.98	+ .03
Rubber, Fine Up-River, Para, lb.	.78	.78	.78	.78	.78	.79	+ .01
Rubber, Ceylon, First Latex	.72	.72	.72½	.72½	.72½	.74½	+ .02½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	45.25	45.25	45.00	45.25	45.25	45.00	— .25
Tire Scrap, lb.	.06¼	.06¼	.06¼	.06¼	.06¼	.06¼	...

1% Extra Chandler Dividend

Earnings for Year Estimated at $1,715,000 or $24.50 Per Share

CLEVELAND, Dec. 5.—The Chandler Motor Car Co. has declared an extra dividend of 1 per cent in addition to the regular 2 per cent quarterly distribution, both being payable Jan. 2 to holders of record Dec. 18.

The company is earning approximately $24.50 per share this year, or around $1,715,000. Shipments of cars for 1916 are 115 per cent greater than in 1915, and orders now actually signed up amount to 20,381 cars.

It has been officially estimated that in 1917 net earnings should exceed $2,800,000, which would be equal to $40 per share. The net earnings this year, $1,715,000, allow a surplus of over $1,000,000, after the payment of the 10 per cent dividends which have been declared since Jan. 1.

Chandler shipments in October were four and a half times larger than a year ago; four times greater in November, and will be six times greater in December.

An important factor of the Chandler situation is that its dealers are without cars and are urging deliveries.

Dividends Declared

Kelly-Springfield Tire Co., quarterly of 1½ per cent on 6 per cent preferred, payable Jan. 2, to stock of record of Dec. 16.

Edmunds & Jones Corp., $1 a share on the common and the regular quarterly dividend on the 7 per cent preferred, both payable on Jan. 2. This is the third dividend the corporation has declared since March 30, 1916.

New Directors Proposed for Pierce-Arrow

BUFFALO, Dec. 5.—The transfer of the Pierce-Arrow property from the present company to the Pierce-Arrow Motor Car Corp. will be made to-morrow, when the new organization takes hold, under the presidency of Colonel Charles Clifton.

It is proposed to make the following persons directors of the new organizations: Charles Clifton, president; Henry May, vice-president; W. J. Foss, Buffalo; J. F. Alvord, president of the Torrington Co.; W. S. Cox, of J. & W. Seligman & Co.; C. J. Schmidlapp, vice-president of the Chase National Bank; J. G. Dudley, of Buffalo; Albert Strauss, of J. & W. Seligman & Co., and C. H.

McCullough, vice-president and general manager of the Lackawanna Steel Co., Buffalo.

The company was recently chartered in this State under the name of the Pierce-Arrow Motor Car & Truck Co., with 350,000 shares of capital stock, 100,000 shares of preferred, par $100, and 250,000 shares of common with no par value. The incorporators were L. D. Adkins, R. J. Trimble and E. S. Hemphill.

Crow Likes Old Name Best

ELKHART, IND., Dec. 4—The Crow Motor Co., this city has changed its name to the Crow-Elkhart Motor Co. The company announced only a few weeks ago that its name had been changed from the Crow-Elkhart Motor Co. to the Crow Motor Co., and now the old name is effective again.

Ford Tractor Capital Now $10,000,000

DOVER, DEL., Dec. 1—The Ford Tractor Co., Ltd., has filed a certificate changing its name to the Ford Tractor Co., Inc., and increasing the capital stock from $1,000,000 to $10,000,000. The company was first incorporated here Nov. 8, 1916.

Porter Rubber Doubles Capital

SALEM, OHIO, Dec. 1—The Porter Rubber Co. will increase its capital from $125,000 to $250,000, to permit expansion and the probable construction of another plant.

Motor Issues Are Lower

General Motors Only One to Show Strength with a Gain of 140 Points

NEW YORK, Dec. 6—The automobile and accessory securities are at present in an apathetic market with a corresponding decrease in value. General Motors, with a gain of 140 points, was the only security to show strength. Last week, this stock declined 90 points on a fluctuating market. Fisk first preferred regained the 9 points lost the previous week by jumping 10 points to 110. Packard preferred gained 3 points.

Chevrolet declined 7 points more this week, making a total of 11 in two weeks. Firestone common dropped 6 points. Studebaker common went down 4 points more to 120 and Willys-Overland common 2⅛ points to 36⅜.

Quotations on the Detroit Stock Exchange were a little higher this week with gains ranging from a fraction to 4½ points. Studebaker common dropped 6½ points in sympathy with the New York quotation. It is reported in Detroit that United Motors stock will soon be listed on the New York Exchange.

Control Three Tire Companies

COSHOCTON, OHIO, Dec. 5.—The interests who took over the plant of the McClurg Rubber Co. at Coshocton, Ohio, have organized a number of corporations, among which are the Midland Tire & Rubber Co., the Ben Hur Tire & Rubber Co. and the Peerless Tire & Rubber Co. The plant, which is now in operation, will be conducted by the Midland Tire & Rubber Co. The other corporations were chartered in order to preserve the names of the Peerless and Ben Hur tires, which were formerly manufactured at the local plant.

Pennsylvania Crude Reaches $2.75

NEW YORK, Dec. 6—Pennsylvania crude oil was advanced 15 cents yesterday, making $2.75 a barrel paid producers, the highest price ever reached in the history of the oil industry. A year ago when oil prices went beyond the expectations of producers the price was $2.50 and $3 oil was predicted.

Milwaukee Gasoline Up 1½ Cents

MILWAUKEE, Dec. 2.—Gasoline prices on the so-called 65-deg. test were advanced 1½ cents per gallon, and on the 70-deg. test 2 cents per gallon, by all oil companies operating in Milwaukee, on Dec. 1. The prices on the lower tests are undisturbed from the last change, effective Oct. 11.

Parker Rust-Proof Issues Stock

DETROIT, Dec. 4—The Parker Rust-Proof Co. has authorized a capital stock issue of $600,000 7 per cent cumulative preferred stock—non-assessable, and $1,700,000 common stock—non-assessable. The present price of the stock is $100.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	70	72	..
J. I. Case T. M. Co. pfd.	87	90	..
Chalmers Motor Co. com.	135	..	+1
Chalmers Motor Co. pfd.	110	115	—1
*Chandler Motor Car Co.	111	112	+1
Chevrolet Motor Co.	165	175	—7
Fisher Body Corp.	38	41	..
Fisk Rubber Co. com.	80	90	..
Fisk Rubber Co. 1st pfd.	110	115	+10
Fisk Robber Co. 2d pfd.	90	100	..
Firestone Tire & Rubber Co. com.	162	165	—6
Firestone Tire & Rubber Co. pfd.	106	108	..
*General Motors Co. com.	650	825	+140
*General Motors Co. pfd.	120	121	..
*B. F. Goodrich Co. com.	69⅜	69½	— ⅜
*B. F. Goodrich Co. pfd.	111	113	—2½
Goodyear Tire & Rubber Co. com.	293	296	—1
Goodyear Tire & Rubber Co. pfd.	108¾	109½	+ ½
Graot Motor Car Corp.	8	9	..
Hupp Motor Car Corp. com.	3⅜	4⅜	— ¼
Hupp Motor Car Corp. pfd.	80	95	..
International Motor Co. com.	48	..	—1
International Motor Co. pfd.	23	..	..
*Kelly-Springfield Tire Co. com.	75	76	—1¼
*Kelly-Springfield Tire Co. 1st pfd.	95	99	—1
Keystone Tire & Rubber Co.	15½	16½	— ½
*Lee Rubber & Tire Corp.	37	37½	—1½
*Maxwell Motor Co. com.	73½	74	— ½
*Maxwell Motor Co. 1st pfd.	81½	82	— ¾
*Maxwell Motor Co. 2d pfd.	49	51	— ½
Miller Rubber Co. com.	255	260	..
Miller Rubber Co. pfd.	108	109	+1
National Auto Corp.	36	37	..
Packard Motor Car Co. com.	168	173	—5
Packard Motor Car Co. pfd.	104	106	+3
Paige-Detroit Motor Car Co.	39	40	+1
Peerless Truck & Motor Corp.	22	24	+1
Portage Rubber Co.	167	169	+2
Regal Motor Car Co. pfd.	20	30	—5
Reo Motor Car Co.	46	48	+ ½
Saxon Motor Car Corp.	76	78	—2
A. O. Smith Corp. pfd.	96¼	97	— ⅜
Springfield Body Corp. com.	85	95	—5
Springfield Body Corp. pfd.	120	130	..
Smith Motor Truck Co.	6⅛	6⅜	+ ⅛
Standard Motor Construction Co.	6	7	—1
Stewart-Warner Speed. Corp. com.	104	106	—2
Stewart-Waroer Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	120	120½	—4
*Studebaker Corp. pfd.	109¾	112	..
Stotz Motor	63	64	—2
Swinehart Tire & Rubber Co.	..	88	..
United Motors Corp.	60½	60¾	—1
*U. S. Rubber Co. com.	65¼	66	..
*U. S. Rubber Co. pfd.	113¾	115	+1½
White Motor Co.	53¼	54	— ¼
*Willys-Overland Co. com.	36⅜	36½	—2⅛
*Willys-Overland Co. pfd.	98⅜	99⅜	+⅜

*At close Dec. 4, 1916. Listed New York Stock Exchange. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	45½	..	+ ½
Chalmers Motor Co. com.	..	150	..
Chaımers Motor Co. pfd.	112	115	..
Continental Motor Co. com.	43¼	44½	+1⅜
Continental Motor Co. pfd.	9¾	10½	..
Ford Motor Co. of Canada	293	305	..
General Motors Co. com.	..	825	..
General Motors Co. pfd.	119	122	+1
Maxwell Motor Co. com.	71½	74½	—2½
Maxwell Motor Co. 1st pfd.	80	83	..
Maxwell Motor Co. 2d pfd.	48	51	..
Packard Motor Car Co. com.	..	175	..
Packard Motor Car Co.	101	..	—3
Paige-Detroit Motor Car Co.	38⅜	39⅜	+ ⅜
W. J. Prudden Co.	53½	56	+4½
Reo Motor Car Co.	46½	47¼	+1½
Studebaker Corp. com.	118	122	—6½
Studebaker Corp. pfd.	107	..	..
C. M. Hall Lamp Co.	29½	31	..
INACTIVE STOCKS			
Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	25	33	..

Frontenac Wins at Uniontown

Race Marred by Death of Three in Accident—Winner Averages 102 M.P.H.

UNIONTOWN, PA., Dec. 2—The first race meet on the local speedway to-day was marred by a sad accident in which three were killed. Hughie Hughes, driver of the Hoskins, and Frank Galvin and his mechanician, Gaston Weigel, were killed when Galvin's Premier swerved in front of the pits and side-swiped one-quarter of the press stand, where Hughes was standing. Hughes and Wiegel were instantly killed and Galvin died later. That to-day's race was under the spell of a hoodoo is manifested in the fact that two others were killed a few days before the race when C. M. Heist and F. E. Bush were killed while in practice after they had been ordered off the track. The car struck the wall at the top of the speedway and went through. The accident was due to a crystallized axle.

That the accidents are not the fault of the new 1⅛-mile board speedway makes the death of five appear all the more under the spell of a hoodoo. The track was in good condition and fast.

Hughes in to-day's 112½-mile race was going at 91 m.p.h. when he pulled up on the Pugh car, which was going slowly, and in order to avoid hitting it Hughes ran his car through the guard rail and out into the field in the center of the track. He then went to the pits and was standing beside his car in front of the press stand, when Galvin's car, going nearly 100 m.p.h., suddenly, through some fault of the brake or wheel, swerved into him and the press stand.

Fully 21,000 people saw the races, the main event being won by Louis Chevrolet in a Frontenac, his time being 1:14:12 for 112½ miles, or 102 m.p.h.; Lewis, in a Premier, was second in 1:16:36½; De Palma, in a Mercedes, was third in 1:17:56 1-5, and Newgard, in a Crawford, fourth in 1:25. First prize was $1,000, second $700, third $500 and fourth $400.

The second race, a 54-mile event for dealers, was won by N. P. Fetterman in Peerless in 40:18. M. F. McCarthy in Murray second and H. L. Robinson in Haynes third.

Hughie Hughes, killed to-day, was an English racing driver. He came to the United States 10 years ago, and recently made his home here. Hughes is of the old school of automobile drivers. In 1904, in France, he drove a De Dietrich in the Gordon Bennett race. In 1911 he won the Savannah Trophy race in a Mercer. The same year saw him third in the Grand Prize race in an Ono. He won the Tacoma Potlach contest in 1914, driving a Maxwell. He also won several hillclimbs with the Allen-Kingstons. He took Christie's front-drive car and drove it 110 m.p.h. at Indianapolis. He was a member of the British Aviation Corps and was 31 years old.

Resta Confirmed as Champion

NEW YORK, Dec. 5—The champion automobile racing driver of 1916 is Dario Resta. The contest for points in the American Automobile Assn. championship standing closed with the running of the 150-mile race at the Ascot Speedway, Los Angeles, on Thanksgiving Day. Resta with his total of 4100 points has a lead of 660 points over Aitken, his nearest rival, and he will be officially crowned by Chairman Kennerdell of the A.A.A. Contest Board at a dinner scheduled in Chicago on Feb. 1 under the auspices of the Chicago Automobile Club.

When it was announced last spring that the American Automobile Assn. would officially designate the 1916 champion the Bosch Magneto Co. immediately offered to award a trophy and $2,000 in cash to the driver so selected, and $1,000 and $500 to the drivers ranking second and third in the final official standing. The B. F. Goodrich Co. added $10,000 to the purse thus created, to be split $5,000, $3,000 and $2,000. Resta will thus receive $7,000 and a cup, Aitken $4,000 and Rickenbacher $2,500.

There were fifteen races which figured in the championship standings and the number of points awarded each was governed by the length and character of entries.

The final scores of all drivers with a ranking in the 1916 championship standing follows:

Dario Resta	4100	George Buzane	210
John Aitken	3440	Eddie O'Donell	185
E. V. Rickenbacher	2910	Chas. J. Devlin	140
Ralph De Palma	1790	Arthur H. Klein	125
Earl Cooper	1405	Jack LeCain	120
Wilbur D'Alene	1120	Glover Ruckstell	100
Thomas Milton	690	Barney Oldfield	80
Pete Henderson	667	Earl DeVore	80
Frank Galvin	645	Omar Toft	75
Ralph Mulford	620	Ora Halbe	60
Howard Wilcox	618	George Adams	55
Josef Christiaens	540	Mel Stringer	55
Dave Lewis	500	Jack Gable	45
Ira M. G. Vail	450	Billy Chandler	40
Jules Devigne	350	Bert Watson	35
Hughie Hughes	275	M. Sorenson	35
Clyde Roads	270	Art Johnson	30
A. H. Patterson	270	Jas. A. Benedict	30
Eddie Pullen	260	F. McCarthy	25
Wm. Weightman, 3rd	240	Andy Burt	25
		W. J. Muller	20

Test Fisher Farm Tractors

INDIANAPOLIS, Dec. 6—Five experimental one-wheel farm tractors, of the type to be manufactured by the new company in which Carl G. Fisher is interested, are being tested to destruction with a view to improving the design, which should be completed March 15. It is planned to start production in July.

Stutz Finishes First at Phoenix

Delno, Winner of State Fair Century, Captures 100-Mile Track Race

PHOENIX, ARIZ., Dec. 1—R. H. Delno of Tucson, driving the same sixteen-valve Stutz with which he won the century grind at the State Fair Nov. 18, won the 100-mile Thanksgiving Day race at the State fair grounds yesterday in 1 hr., 38 min. and 29¼ sec. Delno's time was 4½ min. faster than in the State Fair race, which he won in 1:43:12. R. E. Lambert, driving a Spa, was second in the Thanksgiving contest, his time being 1:42:00½. Roy Meacham in a Mercer finished third in 1:46:12.

Mechanician Killed

W. M. Drennan of Oklahoma City, a mechanician, was killed almost instantly when the Hudson entry No. 5 crashed through the fence on the north turn while R. G. Armstrong, driver, was attempting to pass the car ahead. The accident, which occurred in the seventh lap, was caused by Armstrong swinging to the outside of the track in an effort to pass the car ahead, and as both right wheels went over the bank into the soft earth Armstrong and Drennan were hurled from the car. Drennan was thrown against a post, as the big racer crashed through sixty feet of fence. Armstrong's escape with slight injuries was miraculous.

Pete Thomason in a Ford finished fourth in 1:49:26 and Al Gladney's Overland fifth in 1:49:40. The performance of the Ford, which went 94 miles without a stop, was one of the features of the contest. Thomason threw a tire in the ninety-fifth lap, otherwise would have been in the money. Seven of the nine entrants were running at the finish.

A. A. A. Opens New Offices

NEW YORK, Dec. 2—The American Automobile Assn. is establishing a branch bureau in the Circle Building on Broadway near Fifty-ninth Street.

U. S. Cars Popular in Java

NEW YORK, Dec. 2—Of the 759 automobiles imported into Java for the first 6 months of this year, 668 cars came from the United States, fifty-three from Italy and thirty-two from the Netherlands.

Roads Built Under Federal Supervision

WASHINGTON, D. C., Dec. 2—Nearly 5,000,000 sq. yd. of roadway, the equivalent of 561.9 miles of road 15 ft. wide, were constructed under the supervision of Federal road specialists during the last fiscal year, according to the annual report of the Office of Public Roads and Rural Engineering, of the U. S. Department of Agriculture, just issued. This is more than double the mileage so constructed in previous years. The roads constructed under supervision of the office include experimental roads, post roads, county roads, and roads in National Parks and forests.

Boston Show Space Sold

BOSTON, MASS., Dec. 2—Practically all the space for the Boston show which opens in March has been sold. Provisions may be made later to take care of a few late comers, but they will have to share space with someone else, and possibly go in the basement. The first floor will be given over entirely to cars, and the balconies will have the accessories. There will be more space available this year because the big dining room has been taken over for the next show and this will give a big slice of room. A small section of hallway will be used for a luncheon space.

75 Auto-Lite Men Convene

TOLEDO, Dec. 4—Seventy-five members of the Electric Auto-Lite Co.'s organization met here in convention to-day.

Trumbull S. K. F. Advertising Manager

HARTFORD, Dec. 2—H. N. Trumbull has been appointed Advertising Manager of the S. K. F. Ball Bearing Co., this city.

Rickenbacher Wins at Ascot

Duesenberg Takes 150-Mile Race—Cooper Is Second and Pullen Third

LOS ANGELES, Nov. 30—Eddie Rickenbacher in a Duesenberg to-day won the 150-mile Championship Award Sweepstakes race on the 1-mile paved Ascot Speedway, the final event in the American Automobile Association's contest for the title of champion driver of America. His time was 2:18:15.5. Cooper in a Stutz was second, Pullen in a Mercer was third, and Ruckstell in a Mercer was fourth. Cooper ran out of gasoline ½ mile from the finish, but coasted to the tape. Attendance was 30,000.

Pullen led at the 50th mile, with Rickenbacher, Cooper, Ruckstell and the field following. Pullen's time was 42:55 for the 50 miles, an average of 69.9 m.p.h.

Pullen, Rickenbacher, Cooper and Ruckstell were bunched in the lead in that order at 100 miles. Pullen's time was 1:28:18, an average of 57.95 m.p.h.

There were twelve entries and $5,000 in prizes, divided into $3,000 for first, $1,250 for second, $500 for third and $250 for fourth.

17 Exhibitors for Salon

NEW YORK, Dec. 2.—There will be seventeen exhibitors at the thirteenth annual Automobile Salon, Jan. 2 to 10, in the grand ball room of the Astor. Though the number of exhibitors is one less than the high mark established in 1912, the number of cars will be about 40 per cent greater, as the balcony of the ball room is to be used for exhibiting the overflow.

The list of exhibitors contains one which has heretofore exhibited at the National Shows, the Locomobile Co. of America. The other exhibitors are: White, Brewster, Daniels, Isotta-Fraschini, Lancia, Murray, Navara, Phianna, Rolls-Royce, Simplex, Singer and S-S-E. Custom body builders include Brewster, Holbrook, Locke and Rubay. In addition to these exhibits there will be a half dozen of tires and accessories.

The exhibition of the Navara marks the debut in the automobile field of the Herreshoffs, of Bristol, Conn., prominent builders of racing yachts.

Fritz Leaves Motor Appurtenances

NEW YORK, Dec. 1—George Fritz of Malverne, L. I., has resigned as vice-president and sales manager of the Motor Appurtenances Corp., this city, handling the J & B products, Jiffy jack and Wondertone horns. He will announce his new connection in the near future.

Feeley Supt. Pittsburgh Maxwell Branch

DETROIT, Dec. 4—C. R. Feeley has been appointed superintendent of the Pittsburgh service branch of the Maxwell Motor Co.

France Heavy Buyer of U. S. A. Cars in October

(*Continued from page* 951)

997. Denmark is another country that did not appear in last year's returns, while in October of this year 342 cars, valued at $241,020, were shipped there. During the 10 months of 1916 the exports amounted to 1305 cars, valued at $955,432.

During the 10 months of last year four cars, valued at $2,800, were shipped to Germany. Since then that country has not figured in the export returns. Italy bought seven cars from this country in October last, the value of which was $7,517, while in October a year ago forty cars, valued at $25,887, were shipped there. During the 10 months' period the shipments increased from 210 cars, valued at $134,901, in 1915, to 244 cars, valued at $151,484, in 1916.

Shipments of cars to other European countries amounted to 301 cars, valued at $327,196, in October last, and to 3403 cars, valued at $4,194,615, during the 10 months of this year. Last year the exports amounted to 814 cars, valued at $1,920,176, in October, and to 7502 cars, valued at $20,003,140, during the 10 months' period.

One thousand and twenty-one cars, valued at $718,962, were shipped into Canada in October last, while in October of last year the number was only 189 and the value $202,552. During the 10 months' period the shipments increased from 5238 cars, valued at $4,154,137, in 1915, to 11,118 cars, valued at $8,025,079, in 1916.

S. A. Shipments Increase

The exports of automobiles to all South American countries in October, 1915, amounted to 383 cars, valued at $210,840, while during the 10 months of last year the exports amounted to 2464 cars, valued at $1,277,326. This year the returns show that 302 cars, valued at $195,512, were exported to Argentina in October, while during the 10 months of this year the exports amounted to 4258 cars, valued at $2,206,709. Shipments to other South American countries were as follows: Brazil, forty-four cars, valued at $33,046, in October, and 348 cars, valued at $232,860, during the 10 months. Chile, 195 cars, valued at $158,719, in October, and 1075 cars, $712,748, during the 10 months. Venezuela, thirty-six cars, valued at $23,781, in October, and 447 cars, valued at $284,316 during the 10 months. All other South American countries 113 cars, valued at $64,986, in October, and 816 cars, valued at $509,877, during the 10 months.

Large gains are noted in the exports to the West Indies and Bermuda, the shipments increasing from 267 cars, valued at $173,355, in October, 1915, to 665 cars, valued at $505,198, in October last, and from 2625 cars, valued at $1,478,360, during the 10 months of last year to 4704 cars, valued at $3,152,389, in 1916.

There was also a large increase in the exports to Australia, Asia and Oceania during the two periods under consideration. Detailed figures appear in the tabulation on page 951.

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Ignition

IT seems rather remarkable that after so many years of development we should not yet have arrived at one, single, standard form of ignition for automobile engines. Yet this is really testimony to the automobile engineer's instinct never to be satisfied with what he has but always to want something better.

When the magneto came it was less reliable than the coil and battery, but for a short time only. Soon it was supreme. Then came the starter and its essential battery, so back once more to battery ignition and a general concentration of brains on the problems appertaining thereto; so that we have now battery ignitions which will do everything the magneto ever did, save only to supply their own motive force.

Ignition units of 1917 are vastly more refined in mechanical detail than they ever were before. The high-speed engine has found the weak spots in many a device, and the general redesign thus called for has led to the use of much better principles combined with better construction. The change has spread over several years, of course, but we have now a far wider choice of igniting mechanisms of high quality and great reliability than we ever had before.

Exactly what happens to the gas in a cylinder as a result of passing a spark through it is still unsettled. There is more than one scientific theory and various of the learned men of the world are still working on the problem. The things we may learn from these researches ultimately is the exact effect of different sorts of spark, different spark intensities, sizes and temperatures. Whether the construction of ignition apparatus will be affected when we do possess this knowledge cannot be said. It would certainly have been a help in the past, but cut and try methods have had such fine results that revolutionary changes are unthinkable.

Legal Confusion

A DECISION in the United States Supreme Court establishing the right of any State to tax nonresident automobile owners for the use of the roads opens up such possibilities of confusion that it throws into the spotlight once more the need for making automobile law a matter for the Federal Government.

Roads are a national asset. Easy transportation in the Far West affects prices in the Far East. Entirely apart from the military importance of roads, modern commerce demands that they be everywhere as good as possible.

The present situation with regard to road building is little short of absurd. The same questions are being debated over and over again by different legislatures. The same experiments in road building are being repeated many times in different States. There is an enormous wastage of energy, a prodigious throwing away of money.

The sums which have got to be spent in America in the next 20 years to provide a country with adequate roads are so great and the possibilities for waste of the present system so potent that common sense demands the centralization of authority as essential. It is the only way to get the work done properly and promptly.

Time was when a man's travels would rarely take him beyond the borders of his State. Then State boundary had a real meaning, which to-day it does not possess for the traveler.

100 M. P. H. on Roads

THE old saying, "a place for everything" is brought strongly to mind by the accident which marked the recent Grand Prize race held over the Santa Monica course. Road races over courses such as this are relics of the early days of the industry when speeds of 60 m.p.h. were something out of the ordinary and accidents were correspondingly less likely to be serious, but to-day when speeds of over 100 m.p.h. are possible on such courses an accident assumes possibilities hitherto inconceivable.

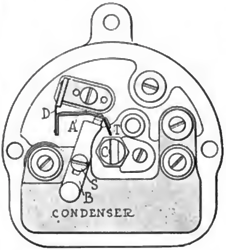
When it is realized that a 3000-lb. car traveling at 100 m.p.h. exerts approximately 2000 hp. at the moment of impact with a stationary body, and that the force of the blow is equivalent to that of a 1-ton weight falling through a distance of 500 ft., the killing of four persons, including the driver of the car, the serious injury of his mechanic and two other people, as well as the destruction of two trees and the car might be accepted as reasonably to be expected.

Ignition Is Much Improved

Battery Systems Are Stronger, More Durable and More Effective—Adjustments Are Easier and Replacement of Wearing Parts Simplified—Few Novelties in Magneto Construction

WITHOUT question the amount of development work done during the year with battery ignition systems has been such that the effectiveness of this form of ignition and its suitability for a permanent place on an automobile can no longer be doubted. The battery-vs.-magneto controversy is still with us, but there is every indication that it will remain in somewhat the same condition as the six versus four argument, and that the final analysis will show both magnetos and battery systems in continued use, each having its own definite sphere.

The real secret of a successful ignition device, whatever its principle, is the accuracy of its manufacture. A timing device, breaker or whatever it may be called, has to perform excessively rapid motions in quick succession and with extremely accurate spacing. Irregularity of operation renders the apparatus useless, and accuracy, especially at high speeds, can only be obtained by workmanship of an extremely high order of merit. Materials must be selected with great care and every process in manufacture watched and inspected with rigid adherence to the fine tolerances allowable. This means that it is a very difficult thing to make a good ignition distributer and coil or a good magneto, and it is only good ones that are any use. With greatly increased demand the ignition manufacturers have had to expand while beset with difficulties in getting the right materials and trouble in obtaining the requisite class of labor, but they have risen to the demand wonderfully.



Mechanism of the bearingless breaker of the Atwater Kent closed circuit system

Atwater Kent closed circuit distributor with the coil mounted alongside

So far as design is concerned, 2 years ago the coming of the high speed engine called for changes, but the ignition breakers operate to-day at much higher speeds than any engine requires; mostly the igniter is in possession of a capacity to ignite at a speed of from 500 to 1000 r.p.m. greater than the engine of any machine on the road.

Two entirely new systems have appeared recently, the Philbrin and the Pittsfield, both being quite different from any of the older varieties. Among the big producers, Atwater Kent has made the most prominent change by adding a closed circuit system, having previously made only an open circuit instrument. Connecticut, the closed circuit system with an automatic throw-out for the switch, should this be left on with the engine stopped, has been altered in detail but not in any principle. Remy, Westinghouse and Bosch, protagonists of the closed circuit, have made practically no changes, and the same is true of the many instruments produced in smaller quantities. A general bettering of mechanical detail is the chief thing noticeable.

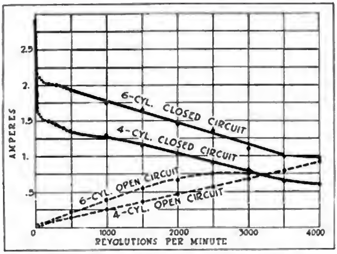
Atwater Kent Uses Closed Circuit

The closed circuit system which Atwater Kent will make in addition to its well known open circuit type is known as the CC and is quite different in construction from any other closed circuit distributer. Externally it is similar in appearance to the older model, and there are the same three units of distributer, coil and switch, but the similarity ends at this point.

It is well known that the Atwater Kent Co. has one of the most up-to-date testing equipments for ignition devices, and it is mainly on the oscillograph and the current measuring instruments that this new ignition has been developed. The curves of current consumption for the closed and open circuit Atwater Kent igniters plotted side by side show that the difference at ordinary running speeds is quite small, and that the greater demand of the closed circuit only appears strongly at very low speeds indeed.

The most striking feature of the device mechanically, is its remarkable compactness and the use of a spring suspension for the breaker blade instead of a pin and socket or bearing of any kind. It would seem that the weight of the only

Six cylinder Atwater Kent type CC breaker mechanism



Comparative current consumption for the two Atwater Kent systems, the closed and open circuit types

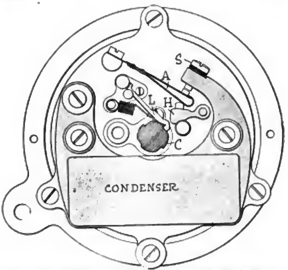


Diagram of the open circuit Atwater Kent system which has not been changed in design

moving part is as small as it could possibly be in any form of instrument, the object, of course, being to get rapid enough action for multi-cylinder engines and to eliminate lag almost completely.

The unit is built up on an iron base which carries the condenser also. The contact arm is a steel stamping tipped with fiber where it touches the cam, and is riveted to a short length of spring steel D which in turn is riveted to the block L. The distributer cover is Bakelite with the terminals molded in place. There is no wiping contact in the distributer, the air gap between the nickel alloy distributer blade and the terminals being 0.015—0.020 in.

The shape of the cam has been determined by the experiments which showed that even the slightest variation in the radius of the curved portions between the flats exerted a powerful influence on the character of the spark. In the four-cylinder cam the limits of tolerance across the corners is 0.002 in. and across the flats it is 0.0015 in.

The light weight of the contact arm is an important factor in the operation of the breaker. In addition to reducing wear to the minimum, it eliminates harmonic vibration and operates to intensify the spark at high speed. Another important point is that the contact is virtually in the center of the contact arm instead of one end, thus reducing inertia and increasing synchronism. Also, because of the location of the arm contact, the two points must come together absolutely squarely with reference to each other.

Revolution of the cam C brings its corners in contact with the fiber tip T of the contact arm A, thus separating the contacts and breaking the circuit. The contacts therefore are together for a considerable period, permitting the coil to be saturated thoroughly. The angular dwell, or the space during which the contacts of the four-cylinder instrument are together, is 47.9 deg. and the contacts open 0.006 in.

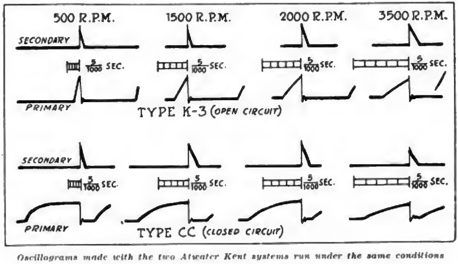
Tungsten is used for the contacts the one in the arm being forced in place, and there is but a single adjustment. To alter the size of the gap between contacts, the screw S is loosened and the arm B moved the required distance, this being slotted where the screw goes through.

Atwater Kent type K3 complete assembly

Owing to its proximity to the contacts the condenser requires to be only about one-sixth the size that would be required were it located in the coil container as has been previous practice. Furthermore the condenser in its new location now is instantly accessible, though cases where it is necessary to touch it are extremely rare.

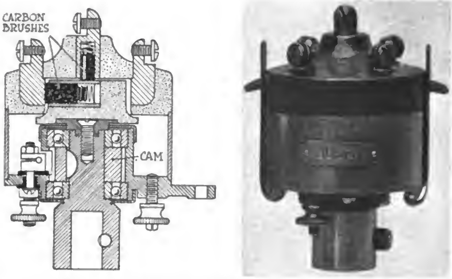
The coils used for both Atwater Kent systems are practically alike except that the coil for the CC system carries a small series resistance for protection in case of very low speeds and in case the switch should be left closed with the engine stopped. These coils are slightly different from their predecessors as the primary and secondary windings are each continuous, instead of being in two sections each and this has permitted a slight reduction in the size of the unit. At present only hand advance is supplied though the instrument will be made with automatic advance.

The CC instrument is made in four-,



Oscillograms made with the two Atwater Kent systems run under the same conditions six- and eight-cylinder types and the oscilligrams indicate that character and intensity of the spark up to speeds of 3500 r.p.m. are excellent.

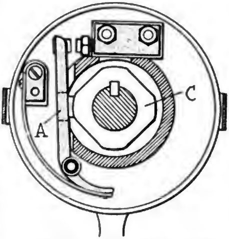
The open circuit, K3 instrument remains unchanged, except that the condenser has been located within the timer-distributer unit and in close proximity to the contacts. This has permitted a reduction in the size of the condenser and, at the same time, increased its effectiveness. In operation, rotation of the cam C draws the lever L forward until the movement of the cam trips the lever which in returning to its original position under the influence of a spring, strikes against the hammer H. The momentum of the hammer H striking the contact arm A instantaneously closes the circuit and opens it again. Here again the only part requiring adjustment is the contact, and even this should not need touching for 10,000 miles. To adjust the contacts the screw S is removed, the face of the contact dressed and one of the thin washers under the screw removed before the screw is returned to position. The standard automatic advance mechanism is provided for the K3 and it is made for four-, six-, eight- and twelve-cylinder engines.



These two views of the Bosch timer-distributor show the very compact nature of the design and how access to the breaker is obtained by removing the distributor head

No Change in Bosch Distributer

The Bosch battery ignition unit is modeled very much upon the magneto breaker and distributer. Rotation of the cam C presses a fiber block which brings the contacts together and a spring separates the contacts at the moment of ignition. Manually operated advance is provided. The distributer is mounted directly over the breaker and consists of the usual cover with the terminals molded in place. A radial arm carries a carbon brush which makes wiping contact with the terminals successively.



Details of the Bosch battery ignition breaker

The switch incorporates a vibrator attachment to facilitate starting; controlled by a button in the center of the switch plug. Under normal starting conditions momentary pressure on the button will produce a single spark at the plug. Turning the plug to the right and depressing it makes the necessary connection to provide a continuous stream of sparks at the plug and the button can be locked in this position until the engine has started.

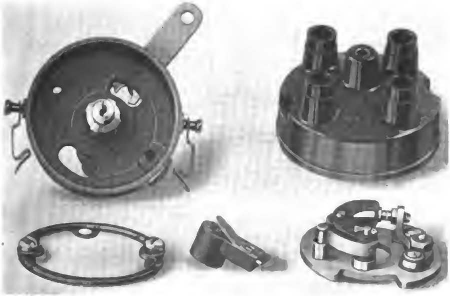
There is only one adjustment, for the gap at the contacts. With the fiber block resting on the top of the cam the contacts should be separated about 0.01 in.

This Bosch battery system has been on the market a very long time, having been produced at a period when starting on the magneto was not as easy as it is now.

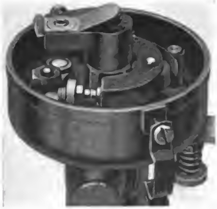
Connecticut Accessibility Improved

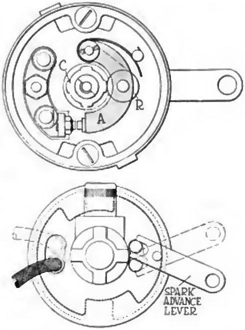
The closed circuit Connecticut instrument has not been changed in principle, the main alteration being in the advancing mechanism, which now is entirely internal and alters the relative positions of cam and breaker arm without moving the distributer or any of the wiring. The whole breaker as a complete unit can now be taken off for cleaning or adjustment more readily than before, as it is now retained by only two screws.

The new advancing device is particularly ingenious. The breaker is set upon a plate which can turn within the stationary outer case. In the bottom of the case is a small slot and through this a pin screwed into the breaker plate projects. On the bottom of the casing and outside of it, close to the slot, is a pin which forms the fulcrum for a short lever. The inner end of this lever is slotted and embraces the pin which comes



Connecticut breaker mechanism is mounted on a plate held by a spring ring under a solid ring. Removing two screws permits the breaker to be withdrawn complete





Left—The Connecticut complete assembly. Center—Removing the distributer head lays bare the breaker. Right—Diagrams of Connecticut breaker and of new advancing mechanism

through from the breaker plate, and the outer end of the lever is linked to the advancing rod.

The breaker carrying plate is held in place by a spring ring and a solid ring, the latter being held by the two screws mentioned.

The detail of the breaker mechanism remains unchanged. In operation, rotation of the cam C touches the fiber roller R in the arm A, thus separating the contacts and the arm is returned to its normal position by a spring.

The feature of the Connecticut system which eliminates the possibility of the battery being exhausted through the switch being left closed with the engine stopped is retained without change. This is effected by the use of a miniature thermostat which is in series in the primary circuit and which controls a mechanism similar to that in an electric door bell. If the engine is stopped with switch closed the primary current, in passing through the thermostat, heats it, thereby bending it and closing a circuit through the buzzer mechanism and this in turn automatically opens the switch. The action of the thermostat can be set for anything from 30 sec. to 4 min., the normal setting being about ¾ min.

There is a new type of high-tension lead connector using a brass ferrule. The wiring is stripped for about ¼ in. and the ferrule is slipped over and screwed into the insulation. Afterward a narrow portion of the ferrule is depressed, thereby locking it securely in place. The wiring fits snugly into tapered holes in the distributer cover, the assembly being completely waterproof.

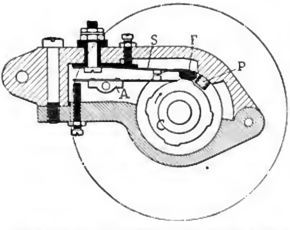
Another new feature is a simplification of the wiring to the coil, this now being so arranged, through the use of a hexagonal terminal, that it is impossible to put a wire on the wrong connection.

Philbrin Entirely New

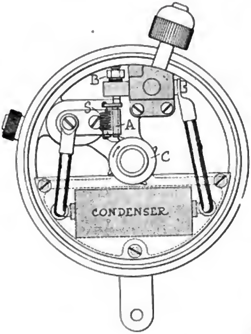
Described fully in THE AUTOMOBILE for Oct. 5, the Philbrin ignition is an entirely new dual system. Primarily it is a single spark ignition of the open circuit type, having a novel breaker mechanism. In addition there is, combined with the switch, a small vibrator which, when in use, sends a continuous stream of sparks to the distributer, providing a very effective ignition for a cold or poor gas. Either the single spark or the other ignition can be obtained by merely turning the switch.

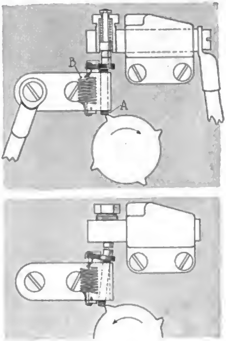
In the breaker there is what may best be called a plunger, carrying the contact at the outer end. The cam has a series of sharply pointed projections which hit the lower end of the plunger and lift it up against the fixed contact, the latter being backed by a small stiff spring. The contact remains closed long enough to saturate the coil, and the plunger is pulled back sharply as the cam passes on, by a coil spring. If the cam turns backwards the plunger gives way before it, being held in place by spring pressure, so the contacts do not close except when the cam is turning the right way. This breaker takes no part in the continuous spark, auxiliary system which sends its high-tension discharge to the distributer direct.

The distributer has a long arm with a blade of peculiar form which does not



Pittsfield ignition unit. The cam C first lifts blade A so closing the contacts, and then raises the fiber block F so lifting blade S and positively separating the contacts again. P is a wick for supplying oil to the cam



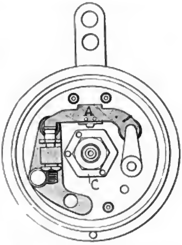


The Philbrin instrument and diagrams showing details of the breaker. The lower right hand view shows what happens when the cam revolves backwards, in which case the contacts are not brought together

touch the terminals molded into the Bakelite cover. It passes in very close proximity to the terminals and the spark passes a small air gap. The reason for the long blade is to insure a continuous stream of sparks at the plug during a considerable part of the piston travel. The current consumption under this continuous spark operation is about 1 amp.

The Philbrin switch also provides for two sources of current—the usual storage battery and an auxiliary set of dry cells. The arm is moved in one direction for the storage battery and the other way for the dry cells. The lever which controls the operation of the single spark or the continuous spark ignitions is a small, continuously rotatable plug. It is alternately marked M and S, designating whether the main or secondary systems are in operation. This switch also reverses the polarity of the current each time it is turned thus conserving the life of the contacts. The coil is contained in a metal case and is completely waterproof. It may be mounted on the dash and in some installations is mounted directly with the distributer mechanism. Two condensers are used, one for each system, and these are quite separate and both are amply protected.

There is but a single adjustment on the system this controlling the opening of the contacts on the main or single spark system. Naturally, improper running of the engine will suggest the advisability of dressing the contacts to smooth surfaces. The adjustment is plainly visible and the gap between the contacts should be 0.025—0.030 in. No adjustment is provided for the vibrator of the secondary, or continuous spark system, the manufacturers stating that it should never be touched.



Latest type of Remy ignition unit and diagram of the breaker. The arm A is a light steel stamping

Pittsfield Has Positive Action

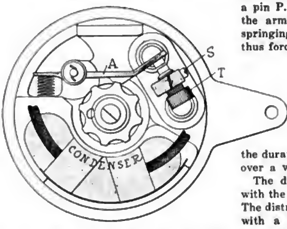
The Pittsfield open circuit system is unique in having the contacts both closed and separated by cam action, the timing not depending on a spring action. The contacts are mounted on two blades of stout spring steel, one having a steel and resting on the cam and the other a fiber block. Normally, with both spring blade ends on the flat part of the cam the contacts are held apart; then as the cam comes round, the shorter blade is lifted till the contacts close. Further movement causes the peak of the cam to pick up the fiber block on the longer blade, and this separates the contacts again. Since both these actions are mechanically performed by the cam there can be no lag due to hesitancy in spring action.

The contacts are permitted to remain together for the maximum length of time, thus assisting in the proper saturation of the primary winding of the coil.

The distributer and coil are in unit with the breaker and the cover is the usual Bakelite casing with the terminals molded in. The distributer arm does not touch the terminals, the spark jumping a small air gap. The coil is completely inclosed and is on top of the cover of which it forms a part.

It is exceptionally easy to disassemble the whole unit. The breaker mechanism is assembled in a sort of handcuff device which is simply clamped around the shaft. Removal of one screw permits the whole to be taken off for inspection. The only adjustment is for the opening of the contacts and this is easily accessible from outside the casing. Removal of the distributer cover and coil exposes the distributer mechanism and after the key

Above — Westinghouse unit comprising breaker, distributer and coil in one assembly. Below—Diagram of Westinghouse breaker. T is the point adjustment and S the locking screw



holding the camshaft has been withdrawn the whole shaft can be lifted out.

Remy Has Stationary Distributer

The breaker mechanism of the Remy battery ignition unit is very simple, and of magneto type, the cam bearing upon a fiber insert in the breaker arm. The circuit is normally closed and is broken only at the instant of ignition. In the sketch the fiber contact piece resting on the cam is designated by the letter F and it may be mentioned that the fiber is securely riveted to the breaker blade.

All the breaker parts are mounted on a plate which is rotatable within the fixed distributer head, the advancing lever coming out through the casing; there is no provision made for automatic advance.

The distributer mechanism has not been altered and consists of the usual Bakelite cover with the terminals molded in place. There is no wiping contact, the spark jumping from the radial distributer arm to the terminals.

The Remy coil has been altered slightly in the past year. The principle is the same, though certain refinements in the method of binding the high tension end of the winding have been made. On top of the coil there is a miniature resistance coil in series with the primary winding which protects this winding should the engine remain idle for any length of time with the switch closed. In short, it protects the winding and also prevents excessive drain on the battery.

Under ordinary conditions the contact points, which are iridium-platinum or tungsten, should not require attention more than twice a season. They should be adjusted so that the maximum opening is 0.020 to 0.025 in., or the thickness of the gage piece riveted to the wrench.

Rhoades Is Simplified

Sundry mechanical changes affecting the simplicity of the Rhoades open circuit igniter have been made during the year, but there has been no alteration in principle. In the sketch showing the latest type the cam C is loosely mounted on the shaft and rotated by contact with a pin P. As the cam rotates it presses the arm A outward and this arm, in springing back, hits against the lever L, thus forcing the contacts together for an instant. If the cam is rotated in the reverse direction it simply rides over the pin and does not bring the contacts together. The contacts are closed only by the momentum of the arm A so the duration of contact remains the same over a wide range of engine speed.

The distributer cover is conventional with the brass terminals molded in place. The distributer arm is keyed to the shaft with a set screw and cannot be improperly assembled, and the arm does not make contact with the terminals, the spark jumping a small air gap.

Westinghouse in One Unit

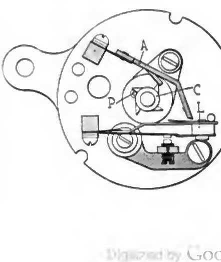
For its battery ignition the Westinghouse company uses the closed circuit principle, the breaker being about as simple as possible. It consists of a stamped steel arm with a contact at one end, and a fiber block about midway of its length, against which the cam strikes. At the other end of the arm there is a coil spring in compression, which keeps the contact points pressed together.

The whole unit is extremely compact, the condenser being mounted on the plate which carries the breaker, while the coil is contained in a chamber above the breaker, the distributer being at the top, above the coil. This means that the only external connection besides the high tension leads is the wire going to the switch.

The distributer arm, which is easily detachable, carries a double-ended carbon brush, the lower end thereof bearing on a ring of copper, and the upper making contact with the successive cylinder terminals. An opening in the casing can be uncovered for the purpose of trimming and adjusting contacts, while access to the distributer is obtained in the usual way. In adjusting the breaker the contacts should be dressed with a fine file and adjusted so that the maximum opening is 0.008 in.

The switch is combined in one mounting with the lighting switches, for attachment to the cowl board, and it is so constructed that the direction of the current is reversed each time the switch is turned. In the back of the switch plate there is what is termed a ballast coil. This is a small resistance in series with the final winding and is to protect the winding and prevent excessive drain on the battery should the motor remain idle with the switch in the "on" position. If this should be accidentally broken the ballast terminals may be temporarily short-circuited.

Rhodes open circuit timer-distributer with diagram of breaker below



Few Changes in Magnetos

Small Mechanical Details Refined But No Radical Alterations Made — Some New Models

PRACTICALLY the only changes which have taken place in magneto construction during the past year concern petty mechanical details. During 1915, when engine speeds were rising rapidly, several of the magneto makers modified their instruments to take care of the new condition. The work they did at that time, however, has proved so effective that there is no need for any further changes at the present time.

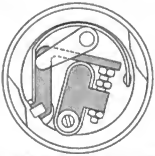
The condition affecting magneto manufacture which has changed for the better is the production of magnet steel in America. The bulk of this steel used to be imported and, when imports were cut off, most of the magneto makers had some trouble to discover a sufficiently reliable source of supply in this country. The steel makers, however, have done their best, with the result that satisfactory American magnet steel is now obtainable.

Whatever may be the ultimate outcome of the battery-vs.-magneto argument applied to passenger cars, it should not be imagined that the present predominance of battery systems in this field has caused a reduction in magneto outputs. The truck industry is using magneto ignition almost exclusively and cutting off the German supply has created a big export business, England and France both taking quantities of machines.

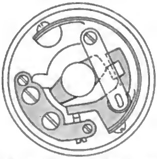
The immediate problem before the ignition industry in general, and the magneto part of it in particular, is the production of a satisfactory ignition device for aviation engines. The uninitiated would not anticipate any special difficulty in this connection. It would seem that a magneto that would operate for years in an automobile ought to be equally perfect for an aeroplane engine.

It has proved, however, that the continuous running at high speed, coupled with extra vibration, calls for a larger factor of safety both electrically and mechanically, while there is also, of course, a strong demand for a reduction in weight, despite the fact that the easy way to counteract the adverse conditions would be to make the machine larger and heavier. The problem is being met and several of the magneto manufacturers think that they have already solved it. Probably in another 12 months it will no longer be a problem.

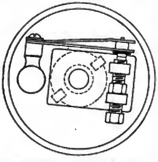
There are two principles of magneto design; one has the coil wound upon the armature and the other has no wires on the armature whatever. The former type was evolved from the ordinary dynamo with, of course, permanent magnets. Some of the first machines had only a low tension winding in the armature and took the current from this through a separate coil which had both a primary and secondary winding. In other words, the current from the armature was merely substituted for current from the battery, the remainder of the system being identical for both sources of supply. A natural development was to eliminate the coil by placing the secondary winding directly on the armature.



In the Bosch type of circuit breaker a bell crank carrying the moving contact point turns with the armature shaft, the cam being on the inside of the breaker box



In the Dixie breaker a bell crank is used in conjunction with a cam which is fitted to the armature shaft



The Eisemann contact breaker consists of two springs separated by a fiber distance piece. The spring member nearest the center carries the movable, rotating contact point

The other system is entirely different. In it there is a small coil with high and low tension winding and this has a soft iron core. The core is so arranged that it forms a circuit passing from the north pole of the magnet through the core to the south pole and back to the north pole again through the armature. The armature is then so constructed that when in one position its iron part completes the magnetic circuit and when the armature is at right angles to this position the magnetic circuit is broken, since the armature then offers to the poles of the magnet surfaces of some non-magnetic metal such as brass or aluminum, or perhaps an air space.

Properly to appreciate the exact differences between the two types a considerable knowledge of electricity is essential, but a point in favor of the second system mentioned which is easy to appreciate is the mechanical simplicity of an armature with no wires on it. In other words, the wound armature type is not so easy to make.

No Changes in Bosch

In common with most concerns in the automobile industry, the Bosch Magneto Co. has been troubled considerably in the past year by shortage of raw material. In consequence of this the company has not considered the development of any new models, having devoted all its energies to an endeavor to maintain production of the existing types. It has been giving close attention to the requirements of the United States government for aviation engines.

There have been no changes in the Bosch system or in the mechanical detail for a good many years. Bosch was among the first to perfect the high-tension magneto with both the windings on the armature and also to develop successfully a system whereby a battery could be used in conjunction with the distributer of the magneto for starting purposes. In the days of large cylinders it was usual with battery ignition and vibrator coils to start the engine by merely switching on, as it would nearly always stop with a compressed charge in one cylinder. In order to provide a similar facility without the complication of a supplementary complete battery system, the Bosch company developed a small coil and vibrator which was combined with

Latest Dixie six cylinder

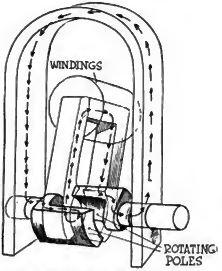


Diagram showing the path of the magnetic flux in the Dixie magneto. The windings are carried on a rocking field of laminated iron through which the magnetic lines are reversed twice in a revolution by means of the rotating poles which extend from the main magnet

the switch and either a small storage battery or a dry battery. In these days of self starters the original need for the duplex system disappeared but it will give, of course, a strong spark at very low speed or will assist starting in cold weather or with poor grades of fuel. There is a very long list of Bosch models and the tendency in recent years has been to increase the production of the waterproof types.

Dixie Has No Armature

The principal exponent of the type with a wireless armature is the Dixie magneto, made by the Splitdorf Electric Co. This machine is unique in having the magnets placed the reverse way to the usual: at right angles instead of parallel to the rotative axis. Further, there is no real armature, but the poles of the magnets rotate. The pole pieces, as shown in the sketch above, are one-sided, so to speak, and the two are connected by a non-magnetic section. Each pole piece will have the same magnetization as the extremity of the horseshoe immediately behind it. Thus, we have two pieces of iron, one with north magnetism and the other with south magnetism revolving in a circle. Mounted in the horseshoe is a coil with a soft iron core and this coil has a "leg" at each end of laminated soft iron extending downward and embracing the rotating pole pieces. Thus, referring to the sketch, in considering one leg, it is easy to see that first the north pole is switched past it and then the south pole immediately afterward. This change causes alternations in the direction of magnetism through the core of the coil and this, in conjunction with the breaker action, sends current through the windings.

An ingenious feature of the Dixie instrument is the method of obtaining spark advance. Maximum efficiency is obtainable from a magneto if the break occurs when the pole pieces and the armature are in one particular relative position. In the case of the Dixie the break should occur always when the rotating pole pieces have reached just one position relative to the legs of the coil core. To insure this movement the spark lever rotates the whole coil unit core, legs and all, exactly the same amount as it rotates the outside portion of the breaker. Thus the magnetic conditions are kept the same. It is possible to adjust the breaker of the Dixie while the machine is running, since the rotating portion is only a cam, the contacts, etc., being stationary.

There have been no changes in Dixie construction except a few small mechanical ones, mainly in connection with the detail of the breaker. The most important of these is a new way of arranging lubricating channels which allows just sufficient oiling to be supplied for the lubrication of the cam but prevents the accumulation of an excess. If a magneto is smothered with oil from the engine it merely drains off through an overflow channel. A slight increase in the range of advance is given on the four- and six-cylinder machines, this being changed from 30 deg. to 40 deg. and the distributer on the four-cylinder magneto has now only one carbon brush and resembles the distributer used on the six-cylinder. The present Dixie output of all types from four- to twelve-cylinder is about 1000 machines a day.

Strong at Low Speed

Unique in construction the Berkshire is another machine working on a somewhat similar principle is the Berkshire magneto, which was a new model during the year and was fully described in THE AUTOMOBILE for July 20, 1916. In this machine the magnets are arranged in the usual way and there is a rotating armature formed partly of iron and partly of aluminum. Referring to the section below, the two main poles of the magnets are A and B, while C and D are iron laminations running parallel with the armature, as shown in the other view. The iron parts of the armature are shown in black and when it is in the position shown the magnetic circuit flows from A to C through a segment in the armature, from C to D through an external circuit and from D to B through the other segment of the armature. Between the outer ends of C and D, joining them together, is a soft iron core upon which the coil is wound. Now when the armature turns so that the iron parts come opposite the poles, instead of bridging the gap between them as sketched, there is no complete magnetic circuit through the core of the coil. This means that revolving the armature continually makes and breaks the *magnetic* circuit, thus causing variations in the magnetic condition of the core of the coil. On the end of the armature shaft there is an electric current breaker of simple construction which is advanced and retarded in the usual way. A particular claim made for this machine is that it will produce efficient spark at as low a speed as 50 r.p.m., while the spark intensity does not become great enough to burn the spark plug points at high speed because the maximum spark occurs at a moderate speed. This is because it is impossible to magnetize the core of the coil beyond a certain degree, and this degree is soon attained. One of the Berkshire machines is made to deliver four sparks per revolution and this on a four-cylinder engine only needs to

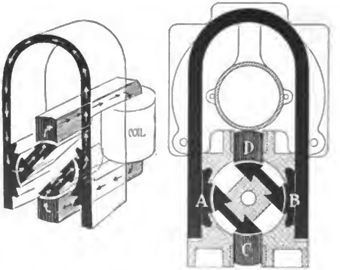


Diagram of Berkshire magneto system

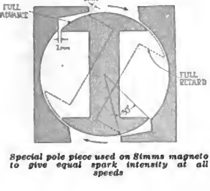
run at half crankshaft speed. The four-spark type is made on six-cylinder engines to run at three-quarter speed and these two machines are applicable to eights, and twelves, by an alteration in the gearing and, of course, the distributer head. Two-spark machines are also made which will operate at the same gearing as that for most other magnetos. In the Berkshire magnetos the distributers have no carbon brushes, the high tension current being taken through brass segments projecting from a revolving cylinder of Bakelite. The outer part of the distributer is furnished with brass pins set so that there is a very small air gap between them and the segment.

Eisemann Has New Model

The Eisemann Magneto Co. is responsible for one of the very few entirely new magnetos, having added a machine which will be on the market early in January, and will be known as the G S. This is really very much the same as the G 4 in both external appearance and in principle. The mechanical detail has been changed considerably. The most important innovation is the use of a large die casting of an aluminum alloy in which the pole pieces are embedded. This single casting forms the end plates, carries the bearings of the armature and the distributer shaft, replacing eight large separate pieces and eliminating the need for a number of screws. This saving, coupled with the fact that the casting comes from the dies almost completely finished, effects a great economy in the cost of production. Therefore, the price of this new machine will be lower than that of the other Eisemann models.

Another new feature is the use of a compressed cloth gear for the distributer, this being used for the sake of quietness. The G S is a waterproof machine and has an extremely neat exterior.

For some years the Eisemann company has been making an impulse starter. This is a device which produces sparks at low speed without the addition of a battery. It may be described briefly by saying that a spring is interposed between the driving pinion in the engine and the armature shaft. When the engine is first turned over a catch holds the armature until movement of the starting crank has compressed the spring fully. As soon as this has occurred the catch is released automatically, causing the armature to fly forward very quickly. This is timed to take place just at the breaking of the contacts and a strong spark is thereby produced. As soon as the engine fires and starts to run a centrifugal device withdraws the catch and the magneto operates exactly as though the impulse starter was not there.



Special pole piece used on Simms magneto to give equal spark intensity at all speeds

The company states that there has been a strong demand for this machine in the tractor field, and it expects to do a large business with the tractor manufacturers in the future.

Another Eisemann feature, which has been very successful, is an automatic spark control which is fitted to the armature of some of the machines. This is a centrifugal governor which operates a sleeve with a spiral groove cut in it which is interposed between the main portion of the armature and its shaft. As the engine speeds up the armature is therefore advanced relative to the driving gear, the breaker mechanism and the distributer, of course, being advanced a similar amount.

Remy Uses Separate Coil

Remy magnetos have not been changed in any way this year and will retain all their present features. The Remy armature carries only one winding, this being a low tension coil of exceptionally large size. The distributer is mounted on the end plate of the machine in the usual way, the coil and condenser unit being entirely separate. The switch is built integrally with the coil so that the latter lies immediately back of the cowlboard, and all Remy machines are arranged to furnish dual ignition, the switch having a position which allows battery current to flow through the windings of the coil and of the armature. In this way the battery current supplements that produced by the armature and insures a satisfactory spark for starting.

A very useful feature of the Remy machines is the device known as the timing button. This automatically locates the armature and distributer in the firing position of No. 1 cylinder. To use this the magneto is disconnected from the engine and the crankshaft is set so that the piston in No. 1 cylinder is at the top of the stroke. The timing button is then pressed and the armature turned by hand until the button is felt to catch. The magneto is then in the correct position and if coupled to the engine without further movement the ignition will be set correctly.

New Eisemann type G S magneto

Die casting used in Eisemann magneto The pole pieces are cast in place and hardly any machining has to be done on this whole piece, which replaces nearly twenty small parts used in the older designs

Simms Has Four Models

Developed by some of the same individuals who designed the original Bosch machines, the Simms Magneto Co., with factories in America and Great Britain, originally built a magneto practically identical in system with the Bosch. In the course of years of manufacturing, mechanical differences have developed so that the Simms and Bosch machines of to-day have very little similarity. At present only four machines are being produced, two for four and two for six-cylinder engines, one furnishing single ignition and the other dual. The single ignition types can be converted to the dual by changing the breaker box and a few other parts.

A special feature of the Simms machine is the design of the pole pieces which have extensions on the edges following the direction of rotation of the armature. These extended edges keep the edges of the armature shuttle within influence of the pole in all positions from full advance to full retard. That is to say, that at the moment of breaking the current the edge of the shuttle is never widely separated from the edge of the pole piece. The possession of one very large contract has heretofore made it difficult for the company to accept much other business, but it is expected that the manufacturing facilities will be much enlarged within a few months.

Spark Type Affects Power

Scientific Tests Show Character of Mixture in Cylinder Affects Quality of Spark Required to Insure Quick Ignition —Successive Sparks May Ignite Where a Single One Fails

By J. D. Morgan

THE following article from *Engineering* (London) although of an extremely academic kind, is none the less very interesting to all who have followed the spark controversy which has been raging more or less ever since the first days of electric ignition. The author is an independent investigator, and a member of several scientific societies, so his opinions are worthy of the most respectful consideration.

Two Contradictory Opinions

"There are current among engineers two opposed beliefs regarding the effects of spark intensity on ignition in internal combustion engines. According to the one, provided a spark is sufficiently strong to produce ignition, an increase of strength has no effect on either the rate of combustion or the maximum pressure attained; consequently such increase has no effect upon the power developed by the engine. According to the other the strength of the spark does have an effect upon the power, and it is therefore assumed that the spark strength influences both the rate of combustion and the maximum pressure attained. Obviously both assertions cannot be true, yet it is possible that the one which is untrue has some foundation in fact, and has arisen out of a misinterpretation of experimental results.

"Regarding the terms 'strength' or 'intensity' as applied to sparks for ignition purposes, no clear meaning is or can be attached to them. The terms are unsuitable because as ordinarily used they refer to the total heat energy of a spark, and this alone does not determine the ability of a spark to ignite a given gas mixture. To meet the difficulty the term 'incendivity' has been proposed by the writer[*] to denote the property whereby a spark produces ignition of a combustible gas. The term is convenient for descriptive purposes, but no quantitative definition can yet be given. In the absence of a standard of incendivity sparks are ordinarily compared by measurements of their heat contents, except in special cases where they are referred to the energy supplied to the circuit which produces the sparks.

Tests in Special Vessel

"The principal investigations on the subject of spark ignition in internal combustion engines have hitherto been carried out by means of engine tests, the effects of different sparks being observed either on explosion diagrams or brake measurements. For the purpose of the investigation here recorded it was decided to explode in a chamber of constant volume weak, quiescent gas mixtures at normal temperature and pressure, for the reason that the main facts can be more easily and definitely determined in this way than in engine tests, where the variable factors of the problem are less easily controlled. The sparking was in all cases at one position, this being approximately at the center of the explosion chamber.

"In carrying out the experiments a mixture was found by trial which produced explosions of moderate rapidity, as the indicator diagrams of such explosions can be more easily and accurately compared than those obtained by very rapid or very slow explosions. Using throughout a coal gas mixture of the same composition, sparks from the following sources were employed:—

(*a*) High-tension magneto.

(*b*) Induction coil with cam-operated make-and-break (primary supplied by 12-volt circuit).

(*c*) Induction coil with vibratory make-and-break (primary supplied by 4-volt circuit); 200 vibrations per second.

(*d*) Lodge condenser apparatus, vibratory make-and-break (primary supplied by 8-volt circuit); 70 vibrations per second.

"The above are the principal types of apparatus used in practice. The heat contents of the sparks measured by means of the author's thermal balance were as follows:—

(*a*) 0.01 joules per spark at 120 r.p.m.
0.03 joules per spark at 1000 r.p.m.
(*b*) 0.02 joules per spark at 80 r.p.m.
0.0018 joules per spark at 1000 r.p.m.
(*c*) 0.0005 joules per spark.
(*d*) 0.026 joules per spark.

"In all cases the diagrams were identical, both as regards the rate of combustion and the maximum pressure. From this it is evident that provided a spark is capable of producing ignition, increase of incendivity has no effect upon the power developed in the engine. This result confirms what has previously been ascertained from engine tests. The fact has not yet, however, met with general acceptance among engineers.

What Is Spark Strength?

"Having regard to the foregoing, the question arises: What ground is there for the belief that engine power is affected by the incendivity or so-called strength of the igniting spark? The experience is common among users of internal combustion engines that an increased spark sometimes results in improved operation of an engine, particularly when weak explosive mixtures are employed. The answer is to be found in the fact that an explosive gas mixture requires for its ignition a spark having not less than a certain incendivity, and the latter varies with the nature and proportions of the mixture. When the proportions of the mixture are at or near the upper or lower limits beyond which ignition is impossible the required incendivity is high. But as the proportions approach that of maximum explosibility the required incendivity rapidly diminishes. Hence for a given gas mixture a certain minimum incendivity is necessary in the spark. If the incendivity is near the limit a diminution in the explosibility of the mixture may result in no ignition, or only intermittent ignition. This can be rectified by employing a spark of higher incendivity, providing a greater margin for gas variations. In a gasoline engine, particularly when running at slow speed, weak mixtures requiring strong sparks for their ignition are often obtained, and when the ignition system is insufficient to provide suitable sparks defective operation of the engine ensues. On replacing the ignition system by another producing stronger sparks the engine works satisfactorily. Arguing from this, the user concludes that the better spark has increased the power of his engine by increasing the rate of ignition or the maximum pressure, whereas actually it has only eliminated misfires.

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[*] "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks." Vol. 54, No. 254, Journal of the British Institution of Electrical Engineers.

"From the practical standpoint the facts relating to 'single point' spark ignition in internal combustion engines are comprised by the statements (1) that provided a given spark is sufficient to produce ignition any increase of incendivity does not affect the power obtainable from the explosion, and (2) that as the mixture passes from the proportion of maximum explosibility toward the higher and lower limits the required incendivity of the spark increases.

No Theory of Ignition

"An outstanding and as yet unsolved problem in connection with ignition apparatus for internal combustion engines is that of defining the least sparks required to produce ignition of a specified gas mixture, and with this problem is associated in general that of spark measurement. In the absence of an established theory of ignition any attempt to define a spark must necessarily be tentative, but some satisfactory temporary expedient is not impossible. Obviously the procedure of defining a spark in terms of the current in some part of the apparatus used for producing the spark is highly unsatisfactory, because sparks defined in this way are not comparable when produced by different apparatus. Any satisfactory method of spark measurement must involve nothing more than the spark. The most obvious and up to the present best developed method is the thermal one. In this it is usual to heat a quantity of gas by a succession of sparks until a steady state is reached, that is, the heat imparted to the gas is equal to the heat lost by the container. The average heating effect of the sparks can then be calculated and the heat content expressed in joules per spark. At first sight it would appear that the incendivity of a spark could be exprssed as a function of the heat content, and if this were possible sparks could for practical purposes be defined in terms of joules per spark. There are, however, two facts which limit the usefulness of the thermal method. The first is that incendivity does not depend upon heat alone, but apparently on heat jointly with temperature, and the other that ignition seems to be the result of a cumulative action which can be set up by a succession of sparks when a single spark fails.

Temperature Important

"It is a matter of simple experimental proof that heat alone does not determine the incendivity of a spark. Using the same source of energy, say a magneto, two different types of sparks can be obtained, one by using the magneto normally and the other by connecting a condenser across the spark gap. The latter is contained in an explosion chamber which is filled with a weak gas mixture, and the magneto is adjusted so that working normally it produces a spark which will not ignite the gas. A condenser of suitable capacity is then attached across the gap, and by means of the resulting spark the gas may be exploded immediately. On measuring the thermal contents of the sparks it is found that the heat contained in the normal magneto spark is not less than that obtained with the condenser, and if a poor condenser is used it may be as much as 100 per cent more, as in one set of experiments carried out by the author. Yet the spark containing more heat failed to produce ignition where the other succeeded. The only apparent difference was the temperature. It might be suggested also that the duration was different, and the shorter duration of the condenser spark caused it to be accompanied by greater mechanical violence. But for this there is no experimental evidence. Both sparks are oscillatory, and the effective portion has apparently the same duration in both cases. It follows, therefore, that incendivity is not a function of heat only, but of heat and temperature. And as the heat-measuring instrument accounts only for total heat, the measurement of joules per spark is only useful for comparing sparks produced by similar apparatus.

"The second fact, that ignition appears to be the result of a cumulative action, is of less practical importance in connection with ignition apparatus for internal combustion engines, seeing that single sparks are now more generally used. But for purely theoretical work the fact is of importance. Using a magneto provided with a variable resistance in its primary circuit to permit large variations of the spark in the secondary circuit, and employing a needle point spark gap, very small sparks can be obtained. Keeping the gas mixture constant and varying only the speed or the primary current of the machine, it was found possible to arrange a condition in which the gas would never ignite with the first spark, and only after a number of sparks had been passed through could ignition be produced. Owing to the extreme difficulty of insuring perfect uniformity of conditions (a trouble which is common in work of this kind), the results were not sufficiently regular to permit of a quantitative deduction, but the persistence of the phenomenon was such at all times that only one conclusion was possible, namely, that succeeding sparks produced a progressive change in the gas which finally resulted in ignition, in other words, the ignition was the result of a cumulative action. The pre-ignition period could be shortened by increasing the strength of the spark (viz., by increasing the speed or the primary current), or by adding a condenser across the spark gap. The largest pre-ignition period noticed was about 2 seconds with the magneto running at 5 r.p.m. In a previous investigation* using low tension sparks the author observed a similar effect. The results obtained with the less active sparks were more regular and the pre-ignition interval was longer. Having regard to the foregoing, the difficulty of defining the least igniting spark for a given gas is apparent, but, as previously stated, where under practical conditions only one spark (or a plurality of simultaneous sparks) is used for igniting an explosive charge the difficulty disappears.

Condenser Effect Important

"The trend of scientific opinion concerning spark ignition is that the action is ionic. It is not suggested that the heat of the spark is unrelated to the process of ignition, but that the thermal and ionic conditions are intimately connected. A natural alternative, if not a substitute, for a thermal instrument for measuring incendivity is the electroscope. The application of the latter for this purpose is not easy, because a number of arbitrary conditions, such as the shape and position of the spark gap relatively to the charged surfaces, and also the magnitude of the charge itself, have apparently to be stipulated before measurements can be usefully compared. Nevertheless the electroscope appears to contain useful possibilities in this connection. It is a matter of simple experimental verification that the sparks of a condenser produce a larger discharge per spark than do sparks obtained when the condenser is removed, although the heat content of the latter may be the same or even greater than that of the former."

Goodyear Cord Tires Easy to Repair

WHEN a Goodyear cord tire has ben damaged it is not necessary for the automobilist to send the tire to the factory for repair, according to L. C. Rockhill, manager of the automobile tire department of the Goodyear Tire & Rubber Co., Akron, Ohio. Any tire repairman can repair one of these cord tires just as he would a fabric tire, using regular fabric, without impairing the efficiency of the casing. For this work no special machine is necessary. In the Goodyear construction six to ten layers of strong cords are used, the number of layers depending upon the size of the tire. The method of applying these cords gives rise to the name of the thread system by which it is widely known. The cords are held in place by a few very fine threads which break when the tire is used, leaving only the cords.

The FORVM

Correctly Figuring Valve Capacity

By E. H. Delling

IN reference to the article entitled Valve Sizes Need Definition on page 703 of THE AUTOMOBILE for Oct. 26, may I be permitted to criticize the suggestion that the area of the clear valve diameter minus the area of the stem should be given as a basis of comparison?

I am of the opinion that it is altogether wrong to consider the area of the valve port as an indication of the "valve capacity," if I may call it so. An example will illustrate my point very clearly. The full-size sketch, Fig. 1, shows the actual dimensions of a valve of the 22-70-hp. Mercer engine.

Employing these few figures we would have a clear valve area of $\frac{2.25^2 . \pi}{4} = 3.97$ sq. in. Subtracting the area of the valve stem, which is 0.110 sq. in., leaves 3.866 sq. in. as the value which your article proposes. Now let us see what actually offers the greatest restriction to the incoming charge. Considering the valve in the extreme, lifted position, the gas will follow the contour of the seat and escape through a slot the length of which is the clear diameter of the valve multiplied with π and the width of which is a line connecting the small diameter of the valve with the largest diameter of the seat. We will call this width h_1. We then obtain the following expression if we call the effective maximum valve opening O_{max}:

$$O_{max} = (d + b) \pi . h_1$$

In our case we would have

$$O_{max} = (2.25 + 0.125) \pi . 0.328$$
$$= 2.45 \text{ sq. in.}$$

This is the actual opening, and comparing it with the port area minus the valve stem, we find that it is only 63.3 per cent of what the former article assumed as correct.

Still this absolute value of 2.45 sq. in. does not permit comparisons and I think we should go a step further. I have always made it a rule to express such values specifically, *i.e.*, per liter or cubic inch of piston displacement. As the Mercer engine has 298 cu. in. displacement, we would have 0.033 sq. in. available for each cubic inch of gas taken in, assuming that the volumetric efficiency is 100 per cent. This value allows a direct comparison of any size and lift of valve for any displacement. The above consideration is the prime reason for double inlet valves. I have never seen this reason stated clearly in any article on that subject. H. R. Ricardo, in a treatise on High-Speed Engines in *The Automobile Engineer* for August, 1916, page 225, states:

"Now the effective area of opening of a poppet valve is equal to the area of the port when the lift is equal to one quarter of the diameter (this is not strictly true but is very nearly so)."

This statement in itself is correct, but it is based on an assumption which is out of the scope of everyday practice. I cannot recall a modern stock engine with such a tremendous lift except the Vauxhall Prince Henry model which, however, can hardly be called a stock product and which represents a very small percentage at any rate. Most valve lifts range from 5-16 to ⅜, very seldom more. So why assume something which is not the average but the exception.

He then proceeds to replace one valve of 2.2 in. diameter by two of 1.55 in. diameter, the combined port area of which would equal that of the single valve. With a lift of current practice, say ⅜ in., we would obtain by above formula for the single valve an opening of $O_{single} = 2.43$ sq. in., for the double valves $O_{double} = 3.45$ sq. in. It will be observed that the gain is appreciable, 42 per cent to be exact.

Some designers may object to using the same lift for the large as well as the small valve. But there is no reason why a small valve should not be lifted as high as a large one, in fact it is much easier to accelerate the small mass of the light valve. I always regarded the lift a factor of the cam shape, spring tension and timing and not so much of the valve size.

Assuming an intake opening of 5 deg. after D. C., a closing of 45 deg. after D. C. and a tappet clearance of 0.005 in., we will have a valve period of 120 deg., or 60 deg. is the included angle formed by the cam flanks. If we assume a base circle of commercial practice, say 1¼ in. diameter, we shall find that lifts over ½-in. are practically impossible due to the fact that the cam shape approaches a point.

To sum up we can come to the conclusion that the valve capacity of an engine changes in direct proportion to the diameter of the intake valves multiplied with the number of valves *and not with the square of the diameter* as is often assumed. That means, 12 intake valves of 1½ diameter have a certain capacity, and whether they are arranged as single valves in a twelve cylinder or as double valves in a six cylinder, is secondary consideration. This assertion is backed up by the high speed of the Sunbeam six-cylinder racing car with double valves and of the Packard racing car with twelve-cylinder aviation engine, having single valves. Both cars have twelve intake valves available for the passage of the inrushing charge; therefore their high volumetric efficiency. Whether the gas is burnt in six or in twelve cylinders is immaterial from the standpoint of valve capacity.

A New Semi-Diesel Engine

By Edwin S. Strickland

AS an experimenter on two-cycle and semi-Diesel engines I have developed a type of construction which entirely overcomes such defects as: Hard starting; backfiring; fouling; waste of unused fuel; accumulation of carbon; condensation of mixture before explosion; and bad or uncontrollable regulation

The first four defects existent in two-cycle engines of the carbureter type are due to co-mingling of fresh and exhaust gas which does not occur with clean air as a scavenger in the semi-Diesel principle.

The last three defects existent in semi-Diesel engines are overcome by varying the quantity and temperature of air compressed, in proportion to the oil atomized against the com-

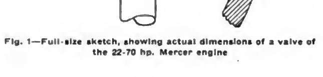


Fig. 1—Full-size sketch, showing actual dimensions of a valve of the 22-70 hp. Mercer engine

At the right are reproduced the two illustrations, Figs. 4 and 5, from an article on engine testing by W. Ferrier Brown in The Automobile Engineer, England, and reprinted in digested form in THE AUTOMOBILE *for Oct. 12. Fig. 4 gives four efficiency curves, viz., mechanical efficiency, brake thermal efficiency, indicated thermal efficiency and available efficiency (as compared with the air standard). Fig. 5 shows the relative values of the "air standard" and the "maximum available" efficiencies as a percentage of the total heat energy of the fuel consumed.*

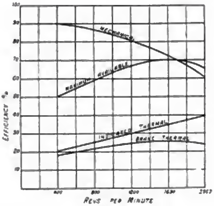


Fig. 4

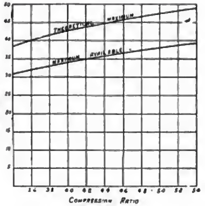


Fig. 5

bustion plate; no partial vacuum is formed in the cylinder.

Kerosene is used for fuel and will operate under idling conditions, while gasoline is used for starting purposes only.

Further improvements consist of a vacuum-breaking valve in the exhaust pipe to prevent drawing the scavenging air cut of the cylinder; a circulation of oil around the bearings, serving the double purpose of lubrication and of forming an oil-seal to prevent compression escaping from the crankcase; a bumped piston head is used to prevent sizing and also to protect the rings from the heat of the explosion; a small fly-ball regulator permits rapid advance of spark and compression by the operator without liability of stalling or reversing. The fly-ball regulator also varies the regulation of warm air to the intake pipe in order to maintain a normal temperature of air admission; and a water-cored exhaust port bridge prevents sizing of same against the piston, while an air passage of 45-deg. angle to the cylinder insures scavenging with no resistance to the air as in a right-angle passage deflector.

The above improvements in connection with the inherent advantages of 40 per cent reduction in parts and weight, cheaper fuel, less surface to lubricate, an explosion each revolution, with no valve in the combustion chamber, make this type of engine the ideal and ultimate motor.

Brake Thermal Efficiency Error

By R. W. A. Brewer

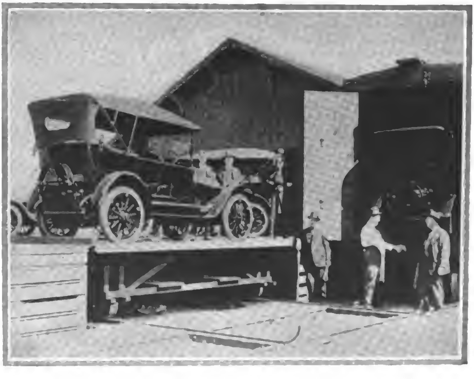
IN Mr. Clayden's abstract of W. F. Brown's article on testing engines, page 620 of THE AUTOMOBILE, Oct. 12, there is apparently an error in respect to the brake thermal efficiency.

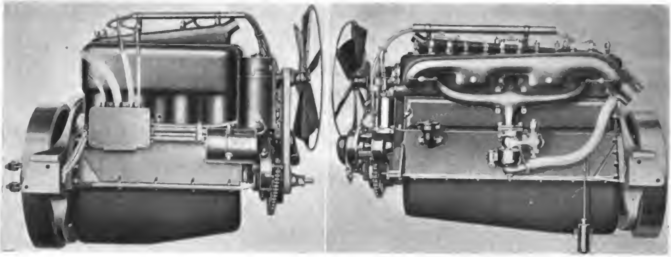
Direct Values Given

It is stated that Fig. 4 shows a "curve of the brake thermal efficiency taken as a percentage of the maximum available efficiency shown in Fig. 5." A study, however, of the curve in question would show that the values given are direct values and indicate the proportion of the total fuel which actually appears as work at the crankshaft of the engine, and this is of the order of 20 to 25 per cent of the total heat in the fuel. Going a step further, the curve in Fig. 4 shows 25 per cent as its best value and assuming the compression ratio of 4 to 1, the "maximum available" from Fig. 5 shows about 34 per cent, so that the ratio of the actual to the maximum available is about 73.5 per cent.

A Car Unloading Platform

AT the right is illustrated a unique device for saving time in unloading automobiles from freight cars. It is the invention of C. A. Dundas, Studebaker dealer in Riverside, Cal. It consists simply of a platform on a level with the height of the freight car floor, the platform being on wheels and moving over tracks. The automobile is rolled off the rear of the freight car and onto the movable platform, the illustration showing one car which has just been rolled on the platform and a second in readiness. The Santa Fé railroad officials thought so well of the scheme that they have made arrangements with Mr. Dundas, the inventor, to have the device installed. The unloading of automobiles at their destinations has long involved a waste of time, which is eliminated by this platform, the expense involved being small.





Left—Engine of the Studebaker four, illustrating junction box for wiring at rear, vertical generator mounting, and chain drive starting motor. Right—Carburetor side of engine shows the arrangement of manifolds on the Studebaker six

Studebaker Continues Four and Six

Redesigned Piston and Electrical System Chief Mechanical Changes—New Patent Auxiliary Seats

STUDEBAKER four- and six-cylinder cars are to be continued for 1917 with several minor changes. As far as the basic design is concerned, the cars are unaltered, but they are presented this year with better finish, better equipment, and better engine characteristics than last year, at a price increase of $130 on the six-cylinder touring car and $55 on the four. Both of these are seven-passenger cars selling respectively for $1,180 and $940.

From an exterior standpoint, the most striking alteration in the Studebaker cars is the use of a gunmetal finish. This is a twenty-five-operation job and the fender trim is in black, giving a distinctive appearance to the new model. Besides the change in finish, there have been a number of other body improvements designed to give more room and comfort to the passengers. The new auxiliary chairs have arms and are an exclusive Studebaker design. They are roomier than the previous auxiliary seats and instead of folding up behind the front seats or under the floor, they are carried beneath the back seat, thus when the auxiliary seats are out of sight, as far as appearance is concerned, this is a five-passenger car.

New Studebaker auxiliary seats which fold beneath rear seats

Another innovation is the use of a reversible front seat. With this the passenger seated beside the driver can sit facing the tonneau or facing forward as he desires. Both the front seats are covered with leather and are fitted with robe straps and are adjustable to all leg lengths.

Another comfort feature is the use of the Blackmore patented storm curtains which open and close with the doors, thus giving all the conveniences of an inclosed body when the side curtains are in place. For those who desire a permanent top in winter there is a new form of convertible which is made exclusively for the Studebaker product and which can be removed readily and the summer top substituted.

Along with the more comfortable body and the better finished exterior, the interior has been given a considerable amount of attention. There are now door pads on the doors. The upholstery is all in semi-glazed, straight-grained genuine leather with curled hair. The tonneau carpet is all wool and bound with leather. The top is silk mohair bound with leather edging, and in the way of interior equipment a new Yale switch lock of pin-tumbler type has been added to guard the car against theft.

Pistons 5 Ounces Lighter

Mechanically, the improvements are very slight and only of a detail nature. Probably the most important is a reduction of 12½ per cent in the weight of the pistons, making them 5 oz. lighter than in the 1916 cars. This reduction in weight has been accomplished by milling out the skirts.

The oil pump has been changed slightly in the way of making a tighter fitting pump which has increased its pumping ability. The rear axle has been stiffened and strengthened, giving a higher factor of safety in this part, and in the electrical equipment, improvements in the design have increased the cranking power by 12 per cent., this increase in the electric cranking effort being due to improved winding of the motor. The generator has also been improved by alterations in the wiring which give much better charging characteristics. About 3 amp. increased current is furnished the battery at a car speed of 15 m.p.h., while the maximum charging rate has not been altered. The practical result of this change as it concerns the driver is that the slow speed operator will get better charging performance and the battery will not be injured by the faster driver. Another detail change in the electrical equipment is in the headlamp mounting by means of which the lamp can be turned and fastened in any position.

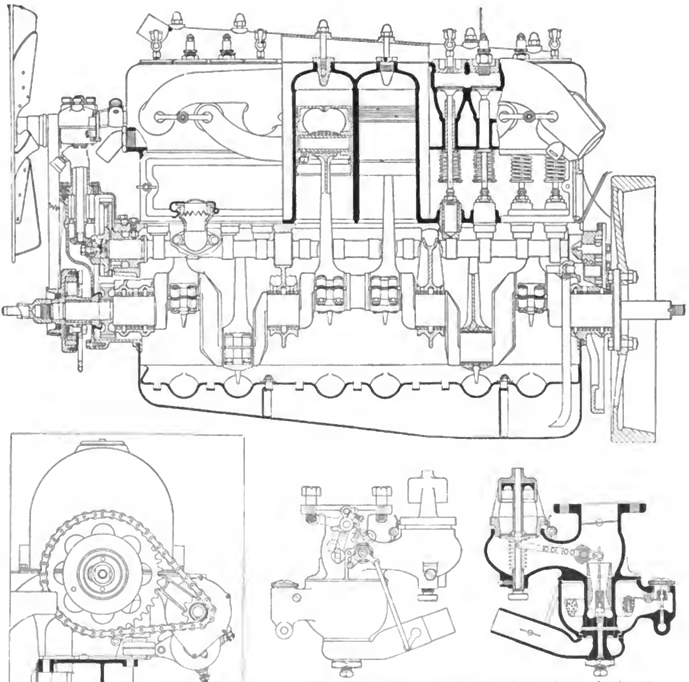
From a manufacturing standpoint, the outstanding feature of the Studebaker line is its standardization. The four and six are exactly similar in design throughout, both engines having their cylinders cast in a single block of similar dimensions, 3⅞ by 5 in., and with all parts similar from one end of the chassis to the other; excepting where structural dimensions differ on account of the difference in the power plants.

For 1916 Studebaker cars were redesigned and a considerable number of alterations were made in the power plants. For 1917, the engines which were introduced have been continued practically without a single change. The other Studebaker characteristics have also been continued this year and the rear axle gearset, cone clutch, and Wagner electric units are all found in the latest models. In the cars of 1916 the cowl gasoline tank was used for a time, but this was changed over so that on the 1917 models there is a vacuum feed from the rear tank.

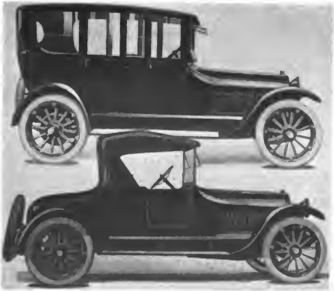
Both the intake and exhaust manifolds are on the left with the carbureter carried on a horizontal flange at the bottom of the intake header. A particular feature of the intake manifold is in the smoothness of the interior surface and the elimination of sharp bends. The hot air stove is attached to the exhaust manifold at the rear of the engine and is carried direct to the air intake of the carbureter by a flexible tube.

Connecting Rods Taper

Cylinders follow conventional design as illustrated in the sectional drawings, and a noteworthy feature of the connecting-rods is the taper from top to bottom in order to give a constant strength column between the wristpin and



The principal change in the Studebaker engine is reduction of reciprocating weight. Observe the large water spaces round the valves The small views show the roller chain drive for the starter and the carbureter with fuel and air adjustments



Above—Convertible design or Every-Weather type which fits over the standard touring body. Below—Side view of the roadster body with full equipment

Upper—Studebaker six-cylinder, four passenger coupé. Lower—Landau roadster which makes a convenient car for physicians and professional men

the crank pin bearing. The center lines of the connecting-rods are slightly offset, as will be noted from the longitudinal section. In the six-cylinder engine the crankshaft is carried on four main bearings, and in the four there are three main bearings. The entire assembly of piston, rod and crankshaft is featured by high strength factors secured by liberal dimensions. The wristpin is secured in the piston boss by a set screw and the bearing bronze for the upper rod bearings secured in the upper end of the rod. At the lower end of the rod there are four alloy steel bolts provided with shims between the cap and bearing for adjustment.

No alteration has been made in the valve action. The camshaft is driven by helical gears directly from the crankshaft and the tappets are the same constant-diameter units adopted last year. These cylindrical pieces, being of the same diameter at the bottom as they are at the top, can be drawn from the crankcase by simply lifting the valve and the spring out of the way.

Lubrication is by a circulating splash system with a gear pump. The oil is driven from the crankcase reservoir through a lead running the entire length of the crank case with a duct to each of the main bearings. The oil is forced through this and the pressure under which it is being fed is registered upon a gage mounted on the dash. The oil passing through the entire length of the main lead flows to the timing gears and acts as their lubricant. The overflow from the main bearings enters the splash troughs where it is picked up by the scoops at the bottom of the connecting-rods.

Electrically, the Studebaker car is Wagner equipped. The starting and lighting system is a two-unit outfit with the motor and generator both mounted on the right. The generator is mounted vertically and driven from the helical gears in mesh with the crankshaft gear. The starting motor engages the crankshaft through a chain drive and is provided with an over-running clutch which releases the starter when the engine is running.

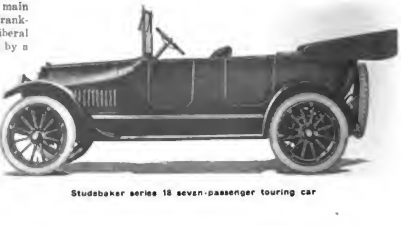
The torque exerted on the crankshaft is over 200 ft. lb., the energy being supplied by a three-cell, 6-volt, 100-amp.-hr. Willard battery mounted under the front seat. For ignition there is a Remy coil and distributer. The headlights can be focussed on any spot desired, and these, together with the dimming device, speedometer and tail lights are controlled by dash switches.

Single Wire System Used

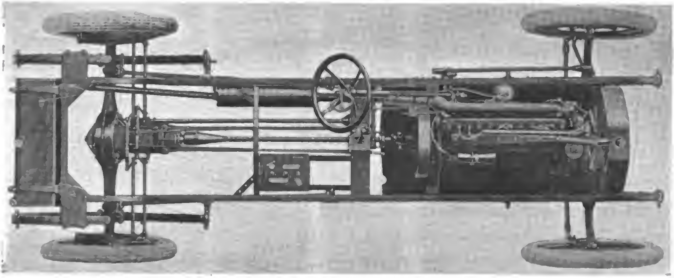
Particular attention has been given to the wiring which is a single system, grounded-return, with the wires carried in flexible metal conduits. The feature introduced last year of placing a junction box on the rear right side of the engine, where it is very accessible, is continued. All the wires go to this box and there are practically none on the body except to the control apparatus on the cowl. Four screws hold the cover plate on the junction box, giving access to any of the connections for the entire system. When the body is removed from the chassis there is no need to make a number of disconnections and furthermore the connections should not work loose, as they are all very rigid. The entire system operates at 6 volts.

The clutch has a pressed cone, the facing being mounted on easy-engaging springs and the throw-out device connected to a ball bearing collar. The drive is direct from the rear clutch member to the gearset at the rear through a 1 5/16 in. alloy steel propeller shaft fitted with a universal at each end. The gearset is bolted by means of a flange to the pressed steel housing of the rear axle and carries on its left side a torsion rod which connects to the main cross member of the frame just behind the forward end of the propeller shaft.

There are also two radius rods which are attached to the side members of the frame with flexible connections to allow for rear spring action, while preserving the alignment of the rear axle. A gear reduction at the axle of 4 to 1 on the



Studebaker series 18 seven-passenger touring car

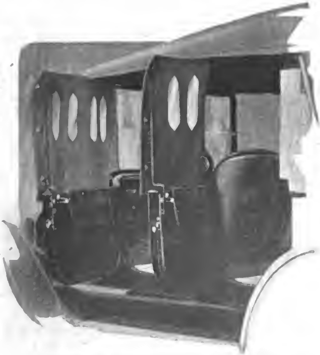


Plan view of the series 18 Studebaker six-cylinder chassis, showing layout of driving and torque members

four and 3.7 to 1 on the six is employed. The three-quarter elliptic spring suspension adopted last year has been continued, the springs being underslung beneath the axle. On both cars they are 51 in. in length with 38-in. front springs.

Wheelbases Differ

On account of the greater engine length there would naturally be a longer wheelbase on the six than on the four. There is a 10-in. difference in this respect, the four having 102 in. and the six 112 in. The tire equipment is 34 by 4 straight side on both cars. Non-skid safety treads are furnished in the rear, while each car is provided with a tire carrier at the rear of the body, together with an extra demountable rim. The wheels are artillery type covered by heavy pressed steel crowned fenders with clear running boards covered with corrugated rolled aluminum. The brakes operate on a 15-in. drum, the service brake having a 2-in. face width and being a contracting type. The hand brake is expanding and has a 1¾-in. face width. The steering gear is an irreversible, full worm-and-wheel type.



New side curtain equipment which opens with the doors

The body line is complete on both the four- and six-cylinder chassis, the cars now listed including the following:

Four-cylinder models:	
Chassis alone	$850
Roadster	930
Touring Car	940
Every-Weather Car (Convertible)	1,140
Landau Roadster	1,150
Six-cylinder models:	
Chassis alone	1,090
Roadster	1,170
Touring Car	1,180
Landau Roadster	1,350
Every-Weather Car (Convertible)	1,380
Touring Sedan	1,700
Coupé	1,750
Limousine	2.600

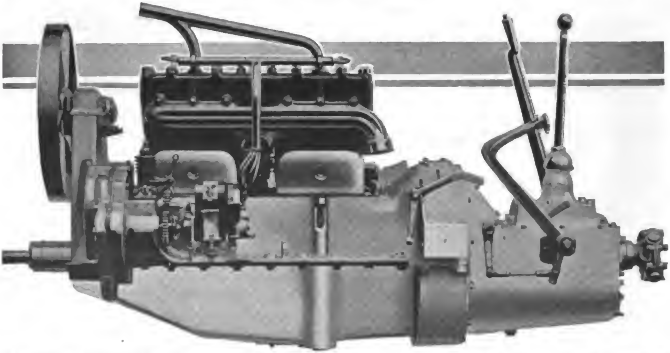
Complete equipment is included in the purchase price, which in all cases is f. o. b. Detroit. The upholstery in the touring and roadster models is straight-grained leather, while the sedan, limousine and coupé can be finished in many different shades and patterns with bedford cord and cloth upholstering. The side seats and back are finished in the same quality and workmanship as the cushions. In the sedan, limousine and coupé the carpet matches the upholstering. The front seats are divided and shaped to fit the back.

Windshield Is Adjustable

One of the features of the equipment is the windshield, which is a special adjustable type designed to fit snugly to the body. There is an overlapping portion of the upper glass which shuts out rain and snow. The steering wheel is 18 in. in diameter, and some of the additional equipment includes the leather covered instrument board, Stewart-Warner magnetic speedometer, battery indicator, oil pressure gage, carbureter control, gasoline gage on rear tank, Yale switch lock, Sparton horn and complete set of tools.

Pocket Book on Gearing

MANY useful tables and much data relating to gearing is contained in a little booklet issued by the Van Dorn & Dutton Co., gear specialists of Cleveland, Ohio, which they will be pleased to send to any engineer who will write them for a copy. Circular pitch, diametral pitch and metric pitches are all dealt with and there are long tables of conversion from diametral to circular giving the thickness of tooth, depth of cut, etc.: Formulas for strength of teeth and general information concerning bevel and spiral gearing are included.



Exhaust side of the new sixteen-valve, four-cylinder unit power plant which is a feature of the 1917 White. Note power tire pump mounting and magneto drive as well as inclosed fan drive

White Four Has Sixteen Valves

Two Wheelbase Lengths Provided on Otherwise Identical Chassis—Valves Are Set at an Angle

(*Continued from page* 949)

and in the experimental laboratory regarding the necessity for having the highest possible volumetric efficiency have been applied. As pointed out in the recent engine review in THE AUTOMOBILE, throughout the entire industry the motor engineers have realized that the way to success along the lines of thermal and mechanical engine efficiency is by securing the closest possible approach to 100 per cent filling on the intake stroke. The White company sums up the situation in the words, "valve efficiency is more important than the number of cylinders," and has used the sixteen-valve design to attain this end.

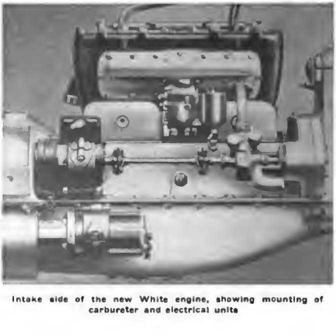
The White company advances nine reasons for the choice of the sixteen valve four. These are:

1—Greater volumetric efficiency.
2—Smaller valves for the same area.
3—Longer duration of maximum gas flow.
4—Cleaner scavenging.
5—Reduction of carbon deposit.
6—Reduction in number of times tuning is necessary.
7—Easiest course of gas flow.
8—Elimination of dead gas pockets.
9—Minimum area of combustion chamber wall.

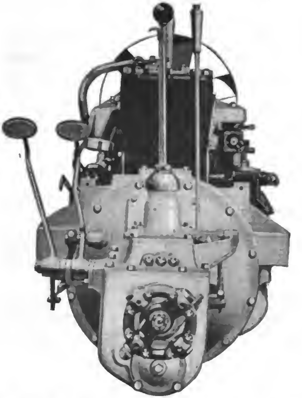
The chassis is made in two wheelbase lengths of 137½ in. for the touring, limousine and landaulet and 124½ in. for the runabout, sedan and coupé. With the exception of the wheelbases the two chassis are identical.

The Unit Power Plant

Combined as a single member, the engine, clutch and gearset form a unit power plant with three-point suspension. The 4¼ by 5¾-in. T-head cylinders are cast in a single block with the valves located at the four-corners of the square about the cylinder circle in the plan view. The cylinders are cast with an open arch between the second and third or middle two cylinders, for lightness this also serving as a factor in preheating the carbureter air. The head casting is entirely separate and contains no valve plugs, an unusual fact in conjunction with a T-head engine. The spark plugs



Intake side of the new White engine, showing mounting of carbureter and electrical units



Rear end view of the White sixteen-valve unit power plant, showing forward universal and control member mounting

are screwed directly through the head and fall in the diametric center of the cylinder, thus giving a symmetrical area for flame propagation and freedom from gas pockets. When the head casting is removed by taking out about fourteen studs, the spark plugs come off with it.

Removing the head exposes the valves and the combustion chambers, rendering the former free for grinding and the latter for cleaning. It takes 15 min. to remove the head and about 5 min. to take off all the side cover plates for the valves, to get at the springs and adjusting nuts.

The piston and rod assemblies are what would normally be expected in a high-speed engine of these dimensions. The pistons are aluminum alloy with three rings and other reciprocating weights have been kept low. The rods are drop-forged I-beams, and the crankshaft is carried on three main bearings which are lined with die-cast babbitt. The shaft is put into running balance by a series of counterweights.

There are two independent camshafts each carrying eight cams. These are driven by helical gears off the crankshaft, the timing gears being located in an independent case at the forward end of the crankcase. Stiffness is a feature of the camshaft to take the torsional stress of the eight valve springs, and the shaft is supported in five bushed bearings.

Valves Are Set at an Angle

A feature of the valves is that they are set on an angle to the vertical center plane. The principal reason for this being that it reduces the size of the combustion space and allows ample water space round the valves. Lubrication is by the full pressure system without splash. The pump is a gear design which leads the oil under a varying pressure commensurate with the speed of the engine to the main bearings. The shaft is hollow and the crank cheeks are also drilled, leading the oil directly to the lower rod bearings under pressure. The pistons and the cylinders are taken care of by the spray from the cranks and the oil then returns through a double bottom strainer to the aluminum crankcase reservoir in the bottom of the crankcase. All the bearings are carried in the upper half of the crankcase, so that when the pan is dropped the main and lower rod bearings are accessible for adjustment. By dropping the pan and removing the lower rod bearing caps the piston and connecting-rod assemblies can be withdrawn through the top of the cylinder, thus eliminating the necessity for removing the cylinder block.

There is a level gage on the side of the crankcase, operated by a float which keeps the driver informed as to the oil supply. The condition of the feed is determined by the pressure gage. Former White cars have carried the oil supply in a dash reservoir. In keeping with the accessible design of the engine there is a removable plate through which the strainer can be taken from the crankcase and cleaned, and there is also a hand hole which allows of access to the inside of the case.

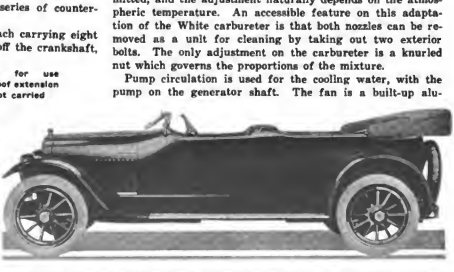
Vacuum feed is used for the gasoline system, the tank being mounted at the rear. The carbureter is a White barrel type of throttle bolted to a new design of intake. There is no header between the carbureter and the intake manifold to which it is attachd by a horizontal flange, the hot air passes through the arch in the center of the cylinder casting with a new type of adjustable stove attached to the exhaust pipe.

Provision for Heavy Fuel

As considerable attention is being paid to the heavier grades of fuel, the stove is of interest. There is a shutter valve on this, the air thus admitted being much cooler than that which enters the slot directly in the stove. The more the shutter is opened the greater the supply of cool air admitted, and the adjustment naturally depends on the atmospheric temperature. An accessible feature on this adaptation of the White carbureter is that both nozzles can be removed as a unit for cleaning by taking out two exterior bolts. The only adjustment on the carbureter is a knurled nut which governs the proportions of the mixture.

Pump circulation is used for the cooling water, with the pump on the generator shaft. The fan is a built-up alu-

Canopy for use when roof extension is not carried



White 1917 seven-passenger touring car which is fitted with the new sixteen-valve four-cylinder unit power plant. It sells for $4,600 minum unit with six blades and is driven by silent chain, the latter being inclosed. Adjustment of the fan drive is secured by placing the fan sprocket on an eccentric unit which is turned by a rack and pinion housed in the chain case. There is a nut connected with the pinion outside the case and when this is turned the adjustment is made by altering the center distance between the fan sprockets.

Two-Unit Electric System

For lighting and starting the Leece-Neville two-unit system is used and for ignition there is a single high-tension magneto. The generator is bolted to the crankcase at the right rear end, between the pump and generator, which are on the same shaft, there are two flexible couplings. The junction box is directly on the top of the generator.

Bendix gear connection is used between the electric starting motor and the flywheel ring gear. Current is supplied by a 12-volt, 75-amp. Willard or Exide storage battery, this voltage being used throughout all the circuits, and the two-wire system is employed.

A single plate, fabric-faced clutch running in oil is used. This delivers the power to a White four-speed gearbox which is over-geared on fourth. The shift is redesigned and, for the first time, the White company is using the cane type. The shifter is mounted on the cover of the gearbox following usual unit power plant practice. The gearset is carried on ball bearings and there is a removable plate at the bottom of the box through which the layshaft may be withdrawn, saving an hour at least on a repair job at this point.

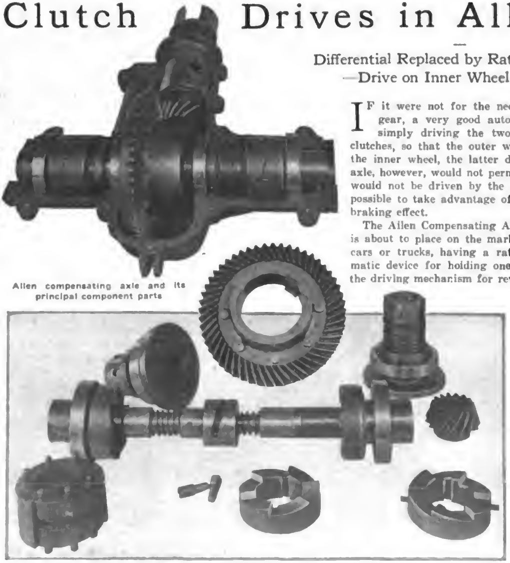
Hotchkiss Drive Used

Two universals and a telescopic joint are used in the drive to the semi-floating rear axle and the hollow shaft is of chrome nickel tube. Both torque and drive are taken through the 60-in. semi-elliptic springs which are underslung beneath the rear axle. The drive connection is at the front end of the spring. There is a kick-up in the rear of the pressed steel channel frame. The brakes are on the rear wheels and the tire size is 37 by 5-in. all around with Goodyear and Goodrich cord tires optional. The extra tires are carried in the rear on forged brackets bolted to the frame and an extra rim is furnished as regular equipment. Steering is by worm and sector.

All the bodies mounted on the sixteen-valve four-cylinder chassis are new. The touring car is a center cowl divided front seat design with sloping windshield. A handy point is the mounting of all the switches and the carbureter control on the steering column. The color finish is optional within limits and there is a new design of one-person top which the White company calls the Mono-top. Full equipment including a power-driven tire pump is included in the purchase price, which for the touring car is $4,600.

Clutch Drives in Allen Axle

Differential Replaced by Ratchet Clutches —Drive on Inner Wheel on Turns



Allen compensating axle and its principal component parts

If it were not for the necessity for providing a reverse gear, a very good automobile axle could be made by simply driving the two road wheels through ratchet clutches, so that the outer wheel on a turn would over-run the inner wheel, the latter doing all the driving. Such an axle, however, would not permit of reversing, and the engine would not be driven by the car in coasting, making it impossible to take advantage of the engine friction to provide braking effect.

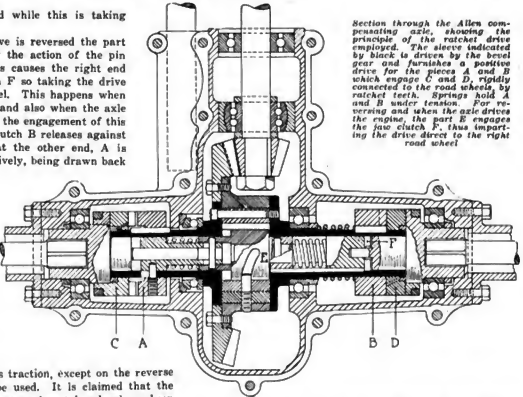
The Allen Compensating Axle Mfg. Co., Philadelphia, Pa., is about to place on the market a new design for passenger cars or trucks, having a ratchet drive and a simple automatic device for holding one of the rear wheels rigidly to the driving mechanism for reversing or when the axle drives the engine.

In the sectional view the sleeve shown in black is driven by the bevel gear and drives positively the two pieces A and B having ratchet teeth engaging the parts C and D which are connected rigidly to the road wheels. The springs which hold A and B up to their work are seen inside the black sleeve on the left and outside on the right. In forward driving the springs keep the ratchets engaged, but when a turn is made the outer road wheel over-runs the clutch on that side releasing against its spring. It is stated that the click of the ratchet cannot be heard while this is taking place.

When the direction of drive is reversed the part E is moved to the right by the action of the pin and helical slot shown. This causes the right end of E to engage a jaw clutch F so taking the drive direct to the right road wheel. This happens when the reverse gear is engaged and also when the axle over-runs the engine. During the engagement of this reverse clutch the forward clutch B releases against its spring, but the clutch at the other end, A is held out of engagement positively, being drawn back by the movement of E as can easily be seen by following the details of the drawing.

As soon as forward drive recommences the movement of the pin in the helical slot releases the reverse clutch and allows the main clutches to operate as before.

With this axle it is not possible to spin a wheel that loses traction, so there is always driving power for the wheel that has traction, except on the reverse where only one wheel can be used. It is claimed that the extensive tests to which the experimental axles have been put on heavy touring cars show that the elimination of the usual differential reduces the tendency to skid on applying brakes almost to vanishing point, since locking one brake cannot put a reverse drive on the other. It is planned to produce the Allen axle as a replacement part for several of the popular cars and also as a manufacturing proposition.



Section through the Allen compensating axle, showing the principle of the ratchet drive employed. The sleeve indicated by black is driven by the bevel gear and furnishes a positive drive for the pieces A and B which engage C and D, rigidly connected to the road wheels, by ratchet teeth. Springs hold A and B under tension. For reversing and when the axle drives the engine, the part E engages the jaw clutch F, thus imparting the drive direct to the right road wheel

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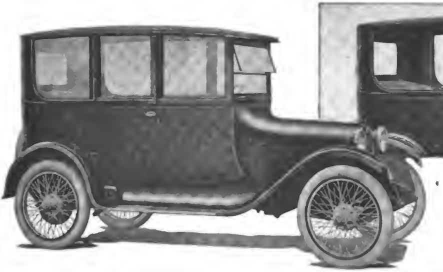
Elegance in New Dodge Convertible Sedan



DESIGNED for use in either Summer or Winter, the new convertible sedan brought out by Dodge Bros., Detroit, is marked by conservative lines in which the influence of the latest American and European body styles is evident. The color scheme of the interior is gray with a bluish tint, a striped effect being carried out in the upholstery, curtains and flexible robe cords, with carpet, front compartment floor and running board coverings also gray. Cushions are of the Turkish type, upholstered in gray and trimmed with narrow lace. All fittings are nickel fitted and there is flush dome light. The front seats are divided.

The rear side windows may be removed and concealed in a narrow compartment in the back of the rear cushion. The other windows lower out of sight and the pillars may be carried under the rear seat. The sedan sells for $1,185, f.o.b. Detroit.

Four-Cylinder Best Tractor Engine

Tests of a Number of Engines Show Great Variations in Performance—Valve Timing Varies Greatly

By A. A. Potter and W. A. Buck

THE following gives the gist of an interesting account of investigations into the efficiency of tractor engines, and is extracted from a paper presented at the December meeting of the A. S. M. E. While many other engineers may not agree with the authors' conclusions, they have compiled their data carefully and the tables give information that cannot fail to be of value to tractor-engine manufacturers.

Authors' Conclusions

From the results of this investigation the authors have derived the following general conclusions:

> The four-cylinder motor is better adapted for belt work on account of the greater number of impulses per revolution.
>
> The single-cylinder motor and the two-cylinder motor operate better than the four-cylinder motor with fuels heavier than gasoline.

Carbureter Requirements

> Carbureters now used are satisfactory for gasoline, but a carbureter jacketed with heat from exhaust gases should be employed when operating with kerosene or with the heavier fuels.
>
> The ordinary automobile motor is too light for traction-engine work. The traction-engine motor should operate at lower piston speeds than the automobile motor. Motors operating at piston speeds of 700 to 900 ft. per minute are giving satisfaction.

Vertical Engines Preferable

> The vertical types of motors are preferable on account of longer life and greater accessibility.
>
> The valve-in-the-head type of motor has the more efficient combustion space and is to be preferred to the T-head or L-head types.
>
> The combination of the forced feed and splash oiling system gives good results.

Jump Spark Ignition

> The jump-spark system, on account of its mechanical simplicity, is the best system of ignition for traction engines of more than one cylinder.
>
> The fuel-economy range is from about 1.30 lb. per brake horsepower per hour at one-fourth load to about 0.7 lb. per hour at full load. The fuel consumption in pounds per brake horsepower per hour is very nearly the same for both gasoline and kerosene.

Thermal Efficiencies

> The thermal efficiencies at full load vary from 14.88 to 19.8 per cent for gasoline fuel, and from 13.7 to 15.97 per cent for kerosene.

The results of the tests relating to fuel consumption and thermal efficiency are given in Table 2. The lower fuel economy of the tests recorded for engine A as compared with tests on engine B (the same engine) was due to the difference in the spark advance. During the operation of engine A a greater spark advance was used, and more cooling water had to be injected into the cylinder with the fuel to prevent preignition. Water injection had to be used also during the tests of several engines with gasoline fuel (engines D, E and F).

Table 2. Fuel Consumption and Thermal Efficiency of the Traction-Engine Motors Tested

Engine	Per Cent of Full Load	Fuel per Hour per Shaft, Hp., Lb.	Thermal Efficiency, per Cent	Engine	Per Cent of Full Load	Fuel per Hour per Shaft, Hp., Lb.	Thermal Efficiency, per Cent	Engine	Per Cent of Full Load	Fuel per Hour per Shaft, Hp., Lb.	Thermal Efficiency, per Cent
A (60 B.H.P.) (Kerosene)	57.8	0.963	13.43	F (40 B.H.P.) (Gasoline)	8.7	3.210	3.85	J	69.1	0.700	18.80
	99.8	0.808	15.88		32.7	1.140	10.34		49.4	0.860	15.10
	70.8	1.082	12.53		32.7	1.120	12.36		49.5	0.930	14.00
	38.2	1.683	7.67		43.6	1.130	11.22		37.2	1.540	8.60
	111.3	0.928	13.93		43.2	0.950	13.02				
	98.8	0.874	14.77		43.9	0.980	12.54	K (20 B.H.P.) (Gasoline)	127.7	1.003	12.69
	70.4	0.996	12.97		64.7	0.808	15.28		66.4	1.178	10.80
	41.5	1.188	10.88		66.2	0.750	16.47		92.9	0.976	13.03
	23.0	2.154	6.01		85.0	0.730	16.94		34.1	1.638	7.77
					86.0	0.860	13.00		51.9	1.280	9.22
B (60 B.H.P.) (Kerosene)	18.1	1.780	7.26		82.4	0.780	15.25		75.8	1.071	11.87
	48.9	1.480	8.74		83.7	0.770	16.08		98.3	0.905	14.06
	17.5	1.750	7.39		84.0	0.770	16.08		36.9	1.948	6.37
	33.5	1.400	8.86						54.6	1.385	9.18
	51.1	1.100	11.76	G (35 B.H.P.) (Gasoline)	105.3	0.643	19.90		75.7	1.043	12.20
	61.9	1.230	10.52		127.0	1.047	12.10		110.3	0.818	15.44
	84.8	0.780	16.58		107.0	0.736	17.30				
	66.4	0.990	13.07		98.5	0.706	18.00	L (16 B.H.P.) (Kerosene)	73.4	0.865	9.71
	65.9	0.760	17.00		81.6	0.779	16.30		45.8	1.447	9.12
	84.6	1.090	12.87		50.3	1.030	12.40		99.8	1.330	9.92
	97.8	0.810	15.97		24.0	1.690	7.50		23.3	1.778	7.42
	104.3	0.980	13.19		80.6	1.045	12.20		45.8	1.108	11.92
	127.8	0.940	13.76		98.8	0.685	18.60		72.1	1.020	12.93
					81.8	0.808	15.80		103.3	1.248	10.57
C (65 B.H.P.) (Gasoline)	28.1	1.227	10.53		52.0	1.025	12.40		23.2	1.865	7.07
	65.1	0.793	16.34		23.6	1.791	7.10		70.8	1.303	10.18
	66.4	0.874	14.82						98.2	1.003	13.17
	100.6	0.731	17.73	H (25 B.H.P.) (Kerosene)	113.0	0.800	15.97		104.4	0.936	14.10
	102.1	0.767	16.89		131.2	1.019	12.54		71.5	1.279	10.32
	112.7	1.010	12.83		92.1	1.042	12.27		70.4	1.185	11.28
	27.5	1.382	9.38		58.1	1.161	11.02		44.8	1.187	11.22
					28.7	2.097	6.10		22.7	1.929	6.84
C (65 B.H.P.) (Kerosene)	68.1	1.008	10.06		110.7	0.794	16.08		71.1	1.103	11.97
	67.8	1.010	12.95		121.7	0.794	16.08		101.3	1.007	13.11
	101.8	0.910	14.36		91.4	0.951	13.45		93.0	1.043	12.64
	36.0	1.582	8.26		57.9	1.230	10.40		45.3	1.103	11.97
	101.3	1.328	9.83		27.2	2.090	6.09		22.9	1.702	7.76
	102.9	1.292	11.63		132.8	0.989	12.93				
	102.9	1.274	10.24		91.9	0.930	13.73	M (20 B.H.P.) (Gasoline)	79.5	0.884	14.20
									30.5	1.506	8.30
D (50 B.H.P.) (Gasoline)	90.0	0.997	13.43	J (25 B.H.P.) (Gasoline)	78.8	0.950	13.70		84.2	0.913	13.30
	94.4	0.890	14.88		80.4	0.810	16.10		18.9	1.753	7.20
	74.8	0.820	16.33		86.8	0.930	13.90		56.8	1.153	10.90
	52.6	0.883	15.17		39.9	1.050	12.40		87.2	1.103	11.40
					24.4	1.640	7.90		60.1	1.030	12.30
E (50 B.H.P.) (Gasoline)	23.0	1.413	10.10		72.4	0.700	17.20		104.1	0.811	15.40
	23.6	1.204	11.87		73.2	0.680	19.20		104.3	0.803	15.60
	47.1	0.670	21.32		96.0	1.040	12.50		60.5	1.103	11.40
	48.8	0.720	19.80		93.5	1.060	12.20		79.2	0.908	13.90
	73.2	0.710	20.10		95.9	1.090	12.00		77.8	1.051	11.90
	74.0	0.710	20.10		98.9	0.730	17.80		41.2	1.428	6.80
	90.6	0.740	19.41		70.1	0.740	17.50				

Table 1. Particulars of the Traction-Engine Motors Tested and the Fuels Used

Engine	Type (all 4-stroke cycle)	Ignition System	Lubrication System	Carburetor	Cooling System	Governor	Fuel			Rating, B.h.p.	Bore, In.	Stroke, In.	Rev per Min.
							Gasoline or Kerosene	Specific Gravity	Heating Value, B.t.u. per Lb.				
A	hor., twin, 2-cyl.[1]	high-tension[7]	mech. op. sight-feed oilers	.....	pump	throttling[2]	K	0.809	19,700	60	....	....	.....
B	(same motor as A, but tested when new)			.....			K	0.800	19,680	0	....	....	.....
C	vert., L-head, 4-cyl.[1]	high-tension[3]	splash and mech. op. sight feed	Bennett	pump	throttling[2]	G K	0.739 0.786	19,670 19,500	65	7¼	9	500
D	vert., T-head, 4-cyl.[1]	high-tension[3]	sight-feed pump	Bennett	pump	diaphragm[4]	G	0.741	19,000	50	6	7	650
E	hor., opposed, 4-cyl.[1]	high-tension[3]	st.-feed pump splash	Kingston	thermo-syphon	throttling[2]	G	0.735	17,880	50	6½	7	500
F	hor., opposed, 2-cyl.[1]	dual	mech. st.-feed oiler	Rayfield	thermo-syphon	throttling[3]	G	0.730	20,600	40	8	9	350
G	vert., L-head, 4-cyl.[1]	high-tension[3]	pump splash	Bennett	pump	throttling[3]	G	0.737	20,000	35	5	7	700
H	hor., L-head, 4-cyl.[1]	high-tension[7]	mech. st.-feed oiler	....	pump	throttling[2]	K	0.789	19,900	25	5¼	8	575
J	hor., opposed, 2-cyl.[1]	high-tension[3]	pump splash	Kingston	thermo-syphon	throttling[3]	G	0.747	19,550	25	6½	7	570
K	vert., L-head, 4-cyl.[1]	high-tension[3]	pump splash	Bennett	pump	throttling[3]	G	0.737	20,000	20	4¼	5¾	800
L	hor., single-cyl.[1, 5]	low-tension[6]	sight-feed oiler	....	hopper	throttling[3]	K	0.805	19,280	16	8	12	400
M	hor. L-hd., 2-cyl., opp.[1]	Kingston dual high-tension	mech. st.-feed oiler	Kingston	pump	throttling[3]	G	0.738	20,290	20	5¼	7	650-720

[1] With mechanically operated inlet and exhaust valves.
[2] High-speed throttling type of governor that regulates the quantity of mixture.
[3] With K-W impulse starter magneto.
[4] Diaphragm type, using pressure of circulating water to control the speed.
[5] Valve in the head.
[6] Make-and-break system using an Accurate oscillating magneto.
[7] High frequency belt driven K-W magneto with trembler coil.

In the case of several engines the valve setting had to be changed before satisfactory operating conditions could be secured. In one case the preliminary tests indicated that the carbureter was too small for the engine. In order to facilitate comparison of various types the motors of the tests were grouped as follows:

Group I—Motors which develop at full load 15 to 26 hp. on brake. The tests recorded for motors H, J, K, L and M are included in this group.

Group II—Motors which develop 26 to 51 b.hp. In this group belong the motors recorded in the tables as D, E, F and G.

Group III—Motors which develop more than 51 b.hp. The tests recorded for motors A, B and C represent this group.

Average Fuel Economy

The average fuel economy for the various groups appears in the table at the right.

From the data on Group I and Group III Table 3 has been computed. Computations could not be made for Group II, as the engines in this class were not operated on kerosene. Table 3 shows the advantages of the kerosene-burning engine. Considering Group I, 10.07 gal. of kerosene will deliver as much power as 10 gal. of gasoline. With kerosene at 10 cents per gallon and gasoline at 20 cents, the cost with gasoline fuel will be 1.99 times that with kerosene fuel for the same power developed. Considering Group III, 12.32 gal. of kerosene will deliver as much power as 10 gal. of gasoline. This gives a ratio of 1.62 to 1 with prices of fuel at 10 cents per gallon for kerosene and 20 cents for gasoline. The advantages of the kerosene engine are offset to a greater or less degree, depending upon the operator, by the added trouble in handling. The life of the motor will also be somewhat shortened when using kerosene fuel. To this should be added the lower reliability with the heavier fuel. In some work done by traction engines reliability is the main factor.

Valve Timing

A study of the valve timing of the different motors in these tests shows no uniformity, except that the majority of the motors are so timed that the inlet valve does not open until after the exhaust valve is closed. The timing given in Table 4 is offered as a result of the authors' study and experience with traction engines.

TABLE SHOWING AVERAGE FUEL ECONOMY FOR THREE MOTOR GROUPS

Per Cent of Full Load	Fuel Consumption, Lb. per B.H.P. per Hour				
	Gasoline	Kerosene	Gasoline	Gasoline	Kerosene
Group	I	I	II	III	III
25	1.853	1.990	1.416	1.47	1.827
50	1.147	1.265	0.893	0.93	1.190
75	0.940	1.044	0.767	0.78	1.013
100	0.855	0.935	0.720	0.73	0.977

TABLE 3—COST OF TRACTION-ENGINE POWER WITH GASOLINE AND KEROSENE

Per Cent Load	Cost per Horsepower-Hour in Cents with								
	60° Baumé Gasoline at Prices per Gallons (in Cents) of					45° Baumé Kerosene at Prices per Gallon (in Cents) of			
	9	12	15	18	21	5	7	9	11
25	2.72	3.62	4.53	5.43	6.34	1.49	2.10	2.70	3.30
50	1.68	2.24	2.80	3.36	3.93	0.95	1.33	1.71	2.09
75	1.38	1.83	2.30	2.75	3.22	0.78	1.10	1.41	1.71
100	1.25	1.67	2.09	2.51	2.93	0.70	0.98	1.26	1.54
Group III									
25	2.16	2.88	3.59	4.31	5.03	1.37	1.92	2.47	3.02
50	1.37	1.82	2.27	2.78	3.18	0.89	1.25	1.61	1.97
75	1.14	1.53	1.90	2.29	2.67	0.76	1.06	1.37	1.67
100	1.07	1.43	1.78	2.14	2.50	0.73	1.03	1.32	1.61

TABLE 4—VALVE TIMING FOR MOTORS OF TRACTION ENGINES

Speed of Motor, r.p.m.	Exhaust Valve		Inlet Valve	
	Opens before outer center	Closes after inner center	Opens after inner center	Closes after outer center
200	20° to 25°	0° to 3°	0° to 3°	15° to 20°
300	22° to 27°	0° to 5°	2° to 5°	15° to 20°
400	27° to 32°	2° to 5°	2° to 7°	15° to 20°
500	30° to 35°	4° to 8°	5° to 10°	18° to 23°
600	35° to 40°	4° to 8°	8° to 12°	18° to 23°
700	40° to 45°	6° to 10°	10° to 12°	20° to 25°
800	45° to 50°	6° to 10°	10° to 12°	20° to 25°

Dolly Madison Four-Passenger Roadster

Made by Madison Motors Corp., Anderson, Ind. The engine is a six-cylinder, 3⅛ by 5 in., Rutenber. Price $1,150 f.o.b. Anderson

Should Study Car Balance

Roadworthiness Equivalent of Seaworthiness and Different from Roadability—Proper Distribution of Weight on Front and Rear Axles Vital

By "Mercury"

WHEN a naval architect undertakes the design of a vessel, he must know accurately the weight and position of every bit of material which will enter into the construction. The sum of the weights must be exactly the displacement on which he has figured, to bring the ship to the water line he has laid down; they must be equally disposed on each side of the center line, so that she will float on an even keel; they must be properly distributed fore and aft, so that she may ride easily on the waves. Too much weight in the bow or the stern will make her steer wildly or plunge heavily into the seas; a lateral concentration of the weight will cause her to roll violently; while if her center of gravity is too high, she may be in danger of being rolled over by a beam sea, a menace to the lives of her crew and the safety of her cargo. In every part, the exact distribution of the weight must conform to the rules of science or the dictates of judgment and experience.

Weight Distribution

So this question of weight distribution has become as much a part of the work of those who design the carriers of the sea, as the determination of form, power and strength. In the design of the carriers of the land, it has received considerably less attention, although there seems to be little doubt that, as the distribution of weight in a ship affects the seaworthiness of the vessel, so the distribution of weight in an automobile affects its "roadworthiness." Perhaps some of this lack of attention may be explained by the fact that while water is a yielding medium which quickly makes apparent any defects in the distribution of the weights, the automobile rests on a solid base, and defects of this nature are not so readily discoverable. Perhaps also, "roadworthiness" is such an indefinable thing that it is difficult to formulate any rules in regard to it.

On the other hand, seaworthiness is also an indefinable thing, but although its attainment was for centuries, and still is, largely a matter for judgment and experience, nevertheless, many logical thories and some exact rules have been produced that have well-nigh revolutionized the art of ship design. While we can hardly expect theories and rules to be propounded within a few years, which in a similar case have required centuries for their production, nevertheless so many and such active minds have in recent years been concentrated upon automobile design and so much energy and wealth have been devoted to the attainment of perfection in automobiles, that it seems remarkable that more serious attention has not been given to this particular subject of the distribution of weight.

Old Models Often Superior

Many of our latest and most up-to-date designs suffer from this lack of attention, which is made only more apparent by their high degree of refinement in other directions. The ability to attain a high speed is a very useless accomplishment if that speed can only be attained on a road like a billiard table. Many a fine modern car that runs with the silence of an electric motor and that will show a fine turn of speed on the testing track, is put to shame on the road by some lumbering old Simplex or Fiat that rolls past, into the ditch and out again, with hardly a tremor, maintaining over all kinds of road surfaces a speed which the other would not dare to attempt. A plain board seat on a well balanced car may be more comfortable than the most luxurious upholstery on a car that bounces all over the road.

This is not entirely a matter of springs, as many people seem to think. One car that I have in mind, although very well sprung, is often at a disadvantage simply on account of the excessive weight of its rear axle. Another very popular car is a positive menace to its occupants and to other road users because of the high position of its center of gravity, and I have personally witnessed serious accidents which were attributable solely to this defect. Again, many chassis are entirely satisfactory when fitted with heavy touring or limousine bodies, but buck like bronchos when equipped as runabouts, while some touring cars that are quite comfortable with their full complement of passengers are very uncomfortable with only the front seats occupied.

Among the many advantages of the multi-cylinder V-shaped engines, their compactness has often been cited, but it is also a fact that the great weight of the engine concentrated so far forward in the chassis has caused, in some cases, cars fitted with this type of engine to steer very wildly at high speed. Instances could be multiplied where "roadability" has been obtained at the expense of "roadworthiness." It is said that before the last British Tourist Trophy race, a competitor who had a very light car with a very heavy engine, arranged the engine to be movable, and by successive trials found the position of the engine in the chassis which would allow his car to maintain its best speed under the very varying conditions of the roads in the Isle of Man.

General Rules Possible

These instances simply point to the importance of this subject. While, of course, the wide variations in detail design make impossible an absolute standardization of the weight and position of each unit which enters into the construction, nevertheless it would appear that some general rules could be laid down for the position of the center of gravity, of the whole car, for the proportions which the weights of the various units should bear to one another and to the weight of the car as a whole and for the positions of these weights with respect to the center of gravity, to obtain the best balance and most satisfactory performance. Such an apparently elemental question as the proportion of the total weight which it is advisable to carry on the rear wheels is far from answered in the minds of most of us, and yet experience can readily supply a figure, which if not an inflexible rule, represents at least a satisfactory solution.

Years ago, the designer of the famous Lanchester cars, to whom we owe the introduction of the worm-drive and the wire wheel on modern cars, aroused considerable controversy by his original views on the proper distribution of weight, but since that time so little has been added to his investigations, that I think it would be extremely interesting, as well as instructive to many of us, to have the opinions both of designers and of users on this subject.

The Rostrum

Has 1905 Overhead Valve Peerless

Editor The Automobile:—I have an old four-cylinder overhead valve Peerless, No. 915, type 11. Can you tell me about what year it was made?

2—What is the gear ratio in fourth?

3—What is the horsepower rating and the r.p.m. of the engine?

4—What is the displacement of the pistons? E. A. F.

Philadelphia, Pa.

—This car was produced during the season of 1905.

2—The total gear reduction on fourth speed, which is direct drive, is 4 2/7. The maximum gear speed would, of course, be very difficult to determine on a car as old as this without some knowledge of its present condition.

3—Approximately 34 hp. figured at 1000 ft. piston speed, or roughly 1100 r.p.m.

4—The piston displacement is about 369 cu. in.

Removing Tar from Car Bodies

Editor The Automobile:—Supplementing my previous communication with reference to removing tar from automobile bodies, as it is a fact because tars are readily soluble in raw linseed oil, it is only necessary to apply the oil thoroughly in order to dissolve the pitch, and any convenient method of applying the oil that will not scratch the painted surface will be found satisfactory.

Would suggest, however, that the painted surface first be washed so as to remove all grit, then after same is dried apply the linseed oil with a soft rag, gently removing the spots of tar or pitch, and they will dissolve and come away from the painted surface without damage to same. Then after the pitch has been thoroughly dissolved, so that the painted surface appears to be free from same, due to the combination with the oil, then apply the ordinary wash of soap and water to remove the oil. This practice will be found more satisfactory than any other method I have ever known and is very easy to apply. H. A. M.

Philadelphia, Pa.

Cannot Change Steamer to Gas Car

Editor The Automobile:—I have a model 0.0 White steamer which has been run about 7000 miles. Would it be advisable to change it into a gasoline car if a suitable engine could be bought? D. O. W.

Marshfield, Ore.

—It is not practical to change your steamer into a gasoline car. Many persons have tried to do so in spite of advice that it cannot be done with any degree of efficiency. You would need a new radiator, engine, clutch, transmission and rear axle, to say nothing of necessary changes in the frame. The axle is high geared and not the right type for a gasoline car.

Timing for Model 17 Buick

Editor The Automobile:—Kindly give valve timing for the model 17 Buick.

Marysville, Ohio. M. M. Car Co.

—The valves for the model 17 Buick will be correctly timed when the exhaust valve closes when piston is 1/16 in. past its upper dead center position and inlet valve opens when piston is 3/32 in. past its upper dead center. These measurements should be taken with a clearance of 0.010 in. between ends of valve stems and rocker arms when both valves are fully closed.

Wiring Diagram of 1910 Pierce 48

Editor The Automobile:—Kindly give wiring diagram of a 1910 Pierce 48 connecting up the coil with the battery and commutator, the original outfit of the Pierce-Arrow being used. I have been starting on the magneto and would like to have the battery to start on for the winter. H. C.

Brooklyn, N. Y.

—Wiring diagram of 1910 Pierce 48 is illustrated in Fig. 1.

Avoid Stopping on Main Highway

Editor The Automobile:—A remarkable demonstration of the wisdom of adopting and constantly living up to the principle of Safety First was given an automobilist of East Orange, N. J., recently. By exercising a little forethought he no doubt saved his wife's life and placed her in a position to safeguard his. On the side of a new and quite slippery road near Millburn, N. J., this gentleman was busy placing chains on his automobile when the thought occurred to him

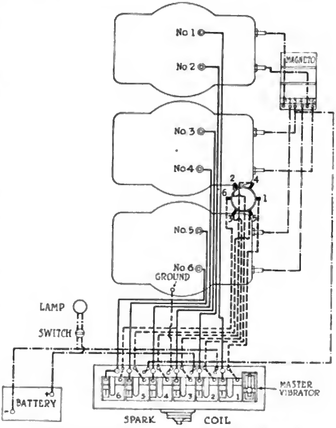


Fig. 1—Wiring diagram of 1910 Pierce-Arrow 48

that his wife, who was standing beside him, was in a dangerous position in the event of a car skidding into his.

Almost immediately after acting on his advice and stepping to the side of the car, a warning cry from her gave him sufficient time to step out of the way and avoid being struck by a large touring car which was skidding sideways and struck the rear end of his car with great force. The impact drove his car ahead, it afterward taking a course at right angles over an embankment down into a field.

This experience teaches automobilists that it is a very wise precaution and in obedience to the principle of Safety First to drive into a side street or roadway when conditions on main thoroughfares are dangerous and there stop for any needed purpose.

The fact that a part of your car is likely to stand in the way of passing cars making it necessary for the drivers to turn to one side, or possibly put on brakes, to allow traffic from opposite direction to pass—in either case inviting a skid—makes the above rule a wise one to follow.

East Orange, N. J. H. J. B.

How Delco Ignition System Operates

Editor THE AUTOMOBILE:—The Delco ignition on the 1916 Cadillac has been a puzzle to me for a long time. I have read instruction book as well as other books on it and still do not get it. Please tell me how the current travels from the battery to the plugs. Do the two breaker points break a primary circuit or does one break the primary and the other a secondary? Does the current come from the battery continuously even at high speeds or from the generator?

Brooklyn, N. Y. H. A. G.

—Current comes from the battery to each of the breakers. One breaker cares for one set of four cylinders and the other for the other set. No current is passing except when the one or other of the contacts is closed. When either pair of contact points come together the battery current passes through the primary winding of an induction coil. As soon as the points separate again the effect of stopping the flow of current suddenly like this is to cause a very high voltage current to be generated in the secondary winding of the induction coil. This high voltage current goes to the high tension distributer and this sends the discharge to the proper spark plug.

In an induction coil there is no connection between the primary and secondary coils. The former is a short coil of fairly thick wire, and outside this a great length of fine wire is wound. When current flowing through the inner coil is stopped a "surge" of high tension current is generated in the thin wire coil and the voltages are roughly in proportion to the lengths of wire in the respective coils.

At low speeds and at high speeds current is supplied by the generator, but it passes through the battery first. The battery is like a tank of water kept full all the time by a pump, the generator being the pump.

1910 Herreshoff Multiple-Disk Clutch

Editor THE AUTOMOBILE:—Will you kindly advise the number of disks in the multiple-disk clutch of the Herreshoff unit power plant in the 1910 or 1911 runabout? Also, please give the best timing for the engine. WM. M. L.

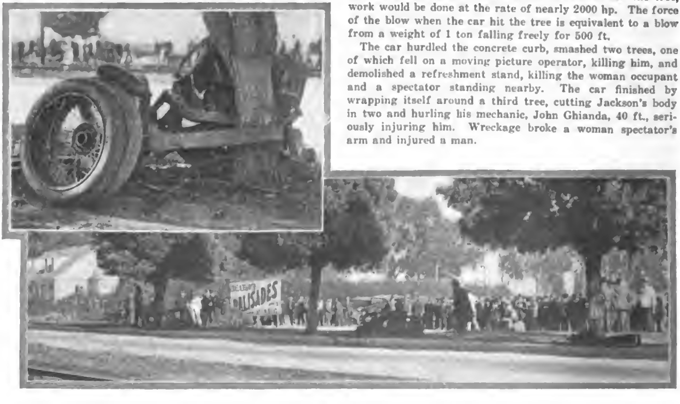
Paterson, N. J.

—There are fifteen driven and fifteen driving disks in the clutch of the Herreshoff 1910 and 1911 runabout. We are unable to furnish the timing of the motor.

A 2000-Hp. Crash at 100 M.P.H.

THE accompanying illustrations of Jackson's car wrecked in the thirteenth lap of the Grand Prize road race held at Santa Monica, Cal., Nov. 18, demonstrate the enormous amount of energy stored up in the rapidly moving car as well as the danger of modern high-speed racing cars traveling on ordinary streets and roadways. This machine was moving at 100 m.p.h. and probably weighed at least 3000 lb. It would then possess a kinetic energy of 1,007,390 ft.-lb. If this was dissipated in 1 sec. as the car struck the tree, work would be done at the rate of nearly 2000 hp. The force of the blow when the car hit the tree is equivalent to a blow from a weight of 1 ton falling freely for 500 ft.

The car hurdled the concrete curb, smashed two trees, one of which fell on a moving picture operator, killing him, and demolished a refreshment stand, killing the woman occupant and a spectator standing nearby. The car finished by wrapping itself around a third tree, cutting Jackson's body in two and hurling his mechanic, John Ghianda, 40 ft., seriously injuring him. Wreckage broke a woman spectator's arm and injured a man.



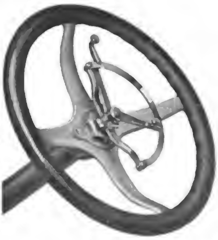
ACCESSORIES

Perry Lock Steering Wheel

BESIDES in a complete steering wheel for any car, Perry locks are supplied to be mounted under the steering wheel on Ford cars. As shown in the illustration, the complete steering wheel is a very neat construction, the locking mechanism, consisting of a hexagon and a hub which is rigidly keyed to the steering post, being integral with the spider hub. When the car is locked, a key being used, the steering wheel has no connection with the steering column and is free to spin like a top, but when the wheel is in the driving position it is securely engaged. Different keys are supplied for every lock.

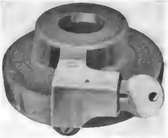
The device for Fords consists of a collar containing a locking device on the same principle as that used in the complete wheel, the steering wheel being locked out of engagement with the column. When in driving position the wheel is held as rigidly as if the lock were not used. In installing the lock no change is necessary except the replacement of the gear housing directly under the steering wheel. This can be done by anyone in 15 min.

With either of these devices the car cannot be towed or driven away as the front wheels are out of control. Price of complete wheel is $15. Ford lock sells for $5, installed.—Perry Auto Lock Co., 1238 Michigan Avenue, Chicago.



Perry lock steering wheel

Perry lock for Ford cars in place on the steering column



Perry lock for Ford steering wheel

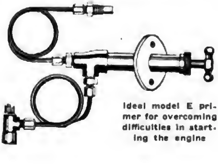
Marvel Spark Intensifier

As shown in the accompanying illustration, this device embodies the principle that forcing the current to leap a gap before reaching the spark plug intensifies the spark which occurs between the points of the plug. A glass case incloses the two electrodes and the width of the gap may be readily adjusted by a small nut outside the case. Adjustment of the points is facilitated by having the spark gap in the intensifier visible through the glass. One intensifier should be fitted to each plug. The devices are neatly finished and simple to attach. Price 75 cents each.—Marvel Mfg. Co., 1020 Washington Boulevard, Oak Park, Ill.

Marvel Spark Intensifier attached to plug

Ideal Pressure Primer

The Ideal model E primer illustrated herewith is designed to overcome difficulties in starting an engine in cold weather, thus saving battery current. The primer, which is attached to the dash, is connected with the feed line and the proper amount of gasoline is injected into the manifold of the engine just before cranking. The stem is threaded and when the primer is not in use a few turns of the handle will close the valve, making it impossible for the device to leak, even under pressure. The manufacturer states that this primer can be used from one season to another without attention, due to the use of two materials on the plunger to avoid the trouble frequently experienced by the leather drying out. Special furnishings for any car are provided and directions included with each primer, the price complete with tubing and all connections being $5.—Ideal Brass Works, Tenth Street and Canal, Indianapolis.



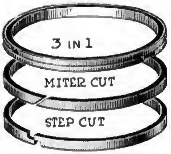
Ideal model E primer for overcoming difficulties in starting the engine

Fillometer for Fords

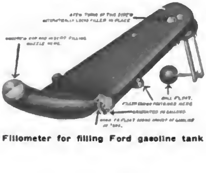
This device permits filling the gasoline tank of Ford cars without disturbing the occupants of the front seat. It consists of a metal casing that screws over the filler cap of the tank and fits flat under the seat cushion with its nozzle projecting past the edge of the seat. A gage is included that shows the amount of gasoline in the tank at all times.—Apex Electric Mfg. Co., 410 West Fifty-ninth Street, Chicago.

Stevens Non-Set Piston Rings

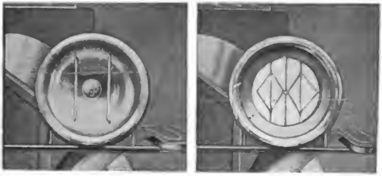
In these individually cast rings the natural skin of the casting is left in the finished ring. By the method of machining and polishing it is claimed that the resulting ring is extremely resilient and long-lived, making a gas- and oil-tight piston. Three styles of Non-Set rings are made—the miter-cut, the step-cut and the three-in-one. The latter is a compound ring made up of two narrow concentric rings lying on an inner ring in a manner that prevents any direct line for the gases to escape. Price,



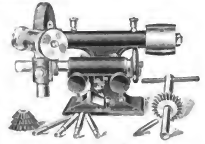
Stevens Non-Set individually-cast piston rings in the three styles made



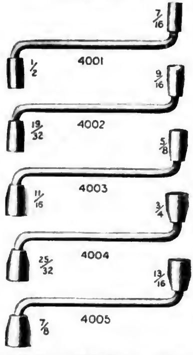
Fillometer for filling Ford gasoline tank



Left—Hughes electric engine warmer for use in unheated garages. Above—Nodaz headlight dimmer, closed at left and open at right. The shutters employed in this device are operated by a push-button



Nasco valve grinder designed to secure any desired bevel



No. 200 set of Walden double socket offset wrenches

miter-cut and step-cut, 25 to 40 cents each; three-in-one, $1 to $1.50, according to size and quantity.—Stevens & Co., 375 Broadway, New York.

Hughes Electric Engine Warmer

Engine and radiator are kept warm while in unheated garages by means of an electric heater operated from the lighting circuit. The heating element is inclosed in a metal case about the size of a dry battery, placed beneath the hood, and the hood and radiator covered with a blanket. The cost is said to be less than 1 cent per hour and the outfit well insulated and safe. Price, $4.—Hughes Electric Heating Co., 211 West Schiller Street, Chicago, Ill.

Walden Double Offset Wrenches

The sockets of these wrenches are placed at the end of a long handle that is bent in the form of a Z. These sockets are made of a solid steel bar, machine turned and broached to size. The handles are made of steel rod and have a length of 9 in. Price, No. 200 set, five wrenches, $2.—Walden Mfg. Co., Worcester, Mass.

Nodaz Headlight Dimmers

An electrically-operated translucent yellow shutter made in sections and installed in the headlight provides a dimming feature. When closed these shutters appear as narrow strips, permitting the searchlight beam of light to shine unrestricted. Pressure on a push-button near the driver's hand opens the shutters, causing the beams of light to pass through the translucent yellow material. Though giving a good driving light and a strong light at both sides of the road, glare is prevented, it is said. This company also makes a small rheostat for dimming headlights. Price, $10. —Ward Leonard Electric Co., Bronxville, N. Y.

Nasco Valve Grinder

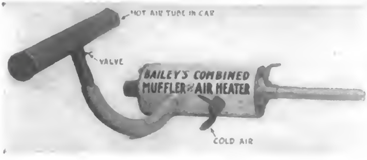
For grinding poppet-type valves to any desired bevel. A spindle, driven from an overhead shaft, carries a grinding wheel. The valve is carried in a swiveled chuck rotated by a small round belt, or, if desired, by hand. It is claimed to grind any valve to a perfect seat in 1 or 2 min., and not to require a skilled mechanic to operate it. Valve-seat reamer for refinishing the valve seats is also included in the set. Price, complete, $30.—National Auto Specialty Co., Tama, Iowa.

Bailey Muffled Heater

This heater is operated by the exhaust gases and is designed for either open or closed cars. The heater consists of a valve placed in the exhaust line between the engine and muffler. From here the gas passes through flexible tubing to a muffled seamless tube. The radiator lies flush with the floor and has an ornamented grilled nickel-plated surface. Price, $12 complete.—Riverside Machine Works, 228 Croton Avenue, New Castle, Pa.

No-Leak-O Piston Rings

The No-Leak-O piston ring is made of one piece. A groove is cut in the ring at right angles with the face and sloping downward for oil sealing. It is the oil sealing feature which is claimed to make the device proof against leaking. On the downward stroke of the piston the square edge of the ring will gather the surplus oil from the cylinder wall and pull it toward the oil pit. On the up-stroke the oil is distributed again on the cylinder wall from the sloping face of the groove. List prices range from 50 cents to $1.30, depending on the diameter.—Automobile Accessories Co., Baltimore, Md.



Bailey combined heater and muffler. It is easily and quickly applied

Industrial Miscellany

Factory

House Wire Wheel Co., Buffalo, N. Y., recently formed, is making arrangements for the erection of a plant for the manufacture of wire wheels for automobiles on a site recently acquired.

E. H. Sprague Mfg. Co., Omaha, Neb., has been formed to manufacture automobile accessories. It has taken over the plant of the Standard Foundry Co., that city.

Adams-Bagnall Electric Co., Cleveland, is completing an addition to its factory including a complete porcelain-enamel plant. Porcelain-enameled reflectors are largely used for industrial lighting.

Saxon Mfg. Co., Toledo, is planning to build a factory to manufacture automobile accessories.

Willard Storage Battery Co., Cleveland, has taken out a permit for interior improvements on its plant in this city. It will also build an $85,000 two-story plant, 135 by 222, at 280 East 131st Street.

Michigan Hearse & Motor Co., Grand Rapids, Mich., is building an addition to its plant. The addition is to be 100 by 60 ft. and will be devoted to the construction of bodies.

Specialty Mfg. Co., Minerva, Ohio, has been formed to manufacture automobile accessories. It will begin operations at once by the manufacture of an automobile light adjuster or tipper to be used in the place of a dimmer. Manufacturing will be concentrated in the Central Garage for the present.

Orrville Rubber Co., Orrville, Ohio, has started manufacturing tires and tubes.

Alpha Rubber Mfg. Corp. will locate in Genoa, Ill., to manufacture automobile tires and tubes. Up to this time the corporation has been selling a product manufactured expressly for it. Seventy-five employees will be worked in the new plant. J. A. Berger is president and general manager; Carl Schneider is vice-president.

Guarantee Tire & Rubber Co., Indianapolis, has been incorporated with a capitalization of $70,000 to deal in tires. The new company supersedes the Guarantee Tire Co. The officers are: G. F. Kreitlein, president; C. W. Minesinger, vice-president and treasurer, and Walter W. Kuhn, secretary. The company has taken over a five-story building at 214-216 McCrea Street for storage purposes.

Metallic Rubber Co., Columbus, Ohio, a subsidiary of the United States Rubber Co., did not open for operation Dec. 1, as was planned, because of delay in securing deliveries of machinery. The concern has taken over the former plant of the Midgley Manufacturing Co., on Dublin Avenue.

International India Rubber Co., South Bend, will begin the manufacture of automobile tires early next year. The first unit of the plant is nearing completion. The tread patterns for the tires to be manufactured by the company have just been patented.

Personal

Walter Woods and J. A. Clark are executives in the Van Cortlandt Vehicle Corp., New York Peerless representatives. Mr. Woods is vice-president and Mr. Clark is sales manager. Mr. Woods was formerly connected with the Peerless factory branch in New York. Mr. Clark managed the sale of the Peerless cars in New York for many years.

W. E. Heye, formerly with the Sharpleigh Hardware Co. of St. Louis, has been appointed traveling representative of the Gibson Co., Indianapolis, state Overland distributer and accessory dealer. He will have headquarters in South Bend, Ind.

Charles Campbell has been appointed manager of the used-car department recently installed by the Missouri-Haynes Co., Kansas City. He was formerly with the Moriarty Motor Co.

H. P. Nelson has been elected treasurer and sales manager of Robert Lurie & Co., New York, Metz representatives.

The Automobile Calendar

ASSOCIATIONS

Dec. 2-9—Electricians' Countrywide Celebration.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Nov. 16—New York City, S. A. E. Meeting.
Nov. 23—Philadelphia, Pa., S. A. E. Meeting.
Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 2-9 — Springfield, Mass., Show, Auditorium, H. W. Stacey, Mgr.
Dec. 7, 8, 9 — Rockford, Ill., Rockford Automobile Trade Assn., Shrine Temple.
Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R. Gates, Mgr.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12-17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 18-25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory, J. J. Callahan, Mgr.
Feb. 19-24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto. Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Automobile Trade.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.

Henry McLaughlin has been appointed factory manager of the Detroit plant of the Lewis Motor Corp. He was formerly superintendent for Golden-Belknap & Swartz.

E. H. Gertz will manage the Mount Vernon and New Rochelle branches of the Hudson Motor Car Co., New York. He assumed his new duties Dec. 1.

F. E. Dennison has joined the sales department of the Hartford, Conn., branch of the Packard Motor Car Co. of New York and will manage the used-car department.

H. S. Jackson of New York has gone to Portland, Me., to manage the Gilson Automobile Co., Mitchell agent.

J. A. Lamkin, formerly of Boston, Mass., has gone to Portland, Me., as sales manager for the D. E. McCann's Sons Co., agent for the Smith Form-A-Truck.

W. M. Williams has opened a general advertising office at 132 South Salina Street, Syracuse, N. Y. Mr. Williams during the past year was a member of the advertising department of the Willys-Overland Co., Toledo, and previously was the advertising manager of the Franklin Automobile Co. for 2 years.

Dealer

De Lion Tire & Rubber Co., New York, has moved to 1922 Broadway.

Saxon Motor Co., New York, has moved to 1744 Broadway. The old store at 251 West Fifty-seventh street will be retained for display purposes.

A. J. Picard, metropolitan distributor for U S L batteries and national distributor for the Genemotor, has purchased the interest of E. S. Morrison in A. J. Picard & Co. Mr. Picard has incorporated his business and will continue under the old name of A. J. Picard & Co. A five-story building is being erected at 9 West 61st Street, which will be ready for occupancy on or about March 1, 1917.

Everard & Oberting Co., Columbus, Ohio, will distribute Macon cars in central Ohio territory. Sales offices are at 140 West Blake Avenue.

E. B. Fidler, Marion, Ohio, has purchased the garage and sales agency of Hoyes & Moyer for a consideration of $50,000. The concern will have the Buick agency. It is located on East Center Street.

Crow-Elkhart Sales Co., Milwaukee, Wis., has been organized to take the Wisconsin and Upper Michigan distribution of the Crow-Elkhart line.

Frank Hanrahan has become state representative in Iowa for the Champion Ignition Co., Flint, Mich.

Auto Tire and Rubber Co., Seattle, Wash., has taken the agency in Western Washington for the Johnson shock absorber.

Mack & Saurer Truck Co. of Missouri, St. Louis, has been organized to handle the trucks named. Negotiations are under way for salesrooms and service station quarters. These trucks were sold by George C. Brinkman Motor Car Co., which recently closed up its affairs.

Kunkle Wagon Works, Baltimore, has taken the agency for the Interstate cars.

Homewood Motor Co., Baltimore, will handle the Abbott-Detroit.

Walbeck Tire & Rubber Co., Louisville, Ky., agent for the Racine tire, has moved into its new building at 305 East Broadway.

Metcalf-Ericson Motors Co., Louisville, Ky., agent for the Empire and Regal, has been appointed state distributor for the Stearns-Knight.

Stahl Automobile Co., Kenosha, Wis., has become a Buick dealer as successor to the agency held for several years by F. A. Rice.

Hallstead Messersmith Co., 310 Michigan Avenue, Buffalo, N. Y., has taken on the King line for Buffalo and vicinity.

S. E. Barnwell, who handles the King line in Louisville, Ky., has moved into new quarters at 813 Third Avenue.

W. C. Wampler Co., King distributor for Dayton, Ohio, has opened up new showrooms and service station at 132 North St. Clair Street.

Times Square Auto Supply Co. has established a western distributing store in Dallas, Texas.

Bearings Service Co., Detroit, has established headquarters at Dallas, Texas, for the Southwest. This is the selling company for the Hyatt Roller Bearing Co., the Timken Roller Bearing Co. and the New Departure Ball Bearing Co. Headquarters are in the new Masonic Building, Main and Pearl Streets.

The Southern Auto & Electric Co., Little Rock, Ark., will handle the Liberty car for the state.

J. V. Le Blanc, Jr., New Orleans, will become distributer of the Jordan. Mr. Le Blanc is a sugar grower at Thibodaux, La., where he sold cars at retail, and recently removed to this city

Val Rolle Wagon & Automobile Co., New Orleans, has entered the field as builders of commercial bodies for Ford chassis.

Burke-Court Motor Co., Memphis, Tenn., has been named distributer for Chevrolet.

Dixie Motor Sales Co., Memphis, Tenn., has succeeded the Franklin Motor Sales Co. and will handle Franklin, Crow-Elkhart and Cole 8 and Gramm-Bernstein trucks.

Shartenburg & Robinson, a New Haven, Conn., department store, has taken on the agency for the Jordan car and a model has been placed on exhibition on the main floor of the store.

Todd Rubber Co. has established a branch in Bridgeport, Conn., and in addition to handling Kelly-Springfield tires will stock accessories. C. E. Minnerly is manager. The concern has branches in New Haven, Ansonia, Danbury, Hartford, New London and Waterbury in addition.

McQuay-Norris Mfg. Co., St. Louis, has made a number of changes in its representatives. L. H. Dally has succeeded H. G. Paro as Chicago manager and the Chicago office has been moved to 1140 S. Michigan Boulevard. Dally has been chief of the McQuay-Norris field force of engineers up to the present. H. W. Sweeney has succeeded J. W. McKeen as manager of the Pittsburgh branch office. R. W. Long has been transferred from the field force of engineers to be manager of the Denver branch. He succeeds H. W. Sweeney.

New Orleans branch of the Goodyear Tire & Rubber Co. is installed in new quarters at 818-20 Howard Avenue.

A. Meyers' Sons Co., Richmond, Va., for many years prominent in the wagon and carriage trade, has been appointed Ford agent. This firm also operates an accessory store at 325 West Broad Street.

Sterrett & Fleming, Washington and Baltimore, has opened a branch in Richmond to show Detroit electric cars and Philadelphia grid batteries.

Arkansas Reo Co., Little Rock, Ark., has been named state agent for the Scripps-Booth.

Patterson Harness Co., Little Rock, Ark., has obtained the state agency for the American tires.

Auto Tire Co., Hartford, Conn., has taken on the Faure tire.

John Millen & Son, Ltd., Montreal, Que., has been appointed distributer for the Boyce Moto-Meter.

P. C. Meredith, Des Moines, state distributor for Bull tractors, has taken the agency for the Dort, and will also distribute the Hercules truck. The new firm is called the Meredith Motor Car Co.

R. W. Llewellyn has been appointed manager of the Columbus, Ohio, branch of the Kelly-Springfield Tire Co.

O'Rourke-Muller Motor Co., New Orleans, has secured the agency for the Elcar and the Ames Ford attachments. A salesroom and service station will be opened at 824 Barronne Street. Temporary offices are at 853 Carondelet Street.

George A. Loque, Jr., New Orleans, distributer of the Hal cars, has opened a salesroom at 640 Barronne Street.

Goodyear Rubber & Tire Co., St. Louis branch, has moved into its new quarters at 3010 and 3012 Locust Street.

National Motor Co., Denver, National, Elgin and Wescott distributer for Colorado and Wyoming, with headquarters at 1616 Broadway, has dropped the Wescott and is now handling only the other two lines.

Northwest Mercantile Co., Kremmling, Col., has secured the Dodge and Velie agency for Grand, Summit and Eagle counties.

Wm. Thorney Auto Co., Denver, Apperson and Regal distributer for Colorado and Wyoming, with headquarters at 1315 Broadway, has gone out of the selling business and expects to start a garage as soon as a suitable location can be secured.

Estabrook-McGraw Tire Co., Denver, is a new tire-distributing agency for Colorado and extensive adjacent territory in the Rocky Mountain region for McGraw tires, with headquarters at 1646 Broadway. The new firm is headed by G. H. Estabrook, Hollier and Briscoe distributer and proprietor of the Estarado Garage.

The King Motors Co. has leased the premises at 2813 Locust Street, St. Louis, Mo., vacated by the Brinkman Motor Car Co., for a factory branch. William Schreiber, who has been connected with Paige, Premier and other distributing agencies here, will be manager. A service station carrying a complete set of parts will be opened in charge of a factory expert.

Nichoalds Co., Detroit, for many years dealer in automobile parts and accessories, has entered extensively into the jobbing business.

Kaehler Motor Car Co., Richmond, Va., has started a fall competition in sales by offering a free trip to the New York automobile show to the employe making the best showing between Nov. 1 and the date of the show.

Satisfaction

¶ Are you satisfied that you are making as much money as your efforts are entitled to?

¶ In the Saturday Evening Post we tell the public that:

> "The National gives and does all that any other car can give and do and *more*."

¶ It is this *more* that gives satisfaction to National owners and greater success to National dealers.

¶ There are definite reasons why you should communicate with the National factories at once. Write and find out what their reasons are!

NATIONAL MOTOR CAR & VEHICLE CORP., INDIANAPOLIS

Sixteenth Successful Year

6 Cylinder

AMERICAS BEST LOOKING CARS

12 Cylinder

LIGHTNESS-ACCELERATION-STRENGTH

These white pages, shown above, will be filled with a message of the greatest interest to every motor-car owner, dealer and manufacturer.

They will constitute our first public announcement of the solution of the lightweight piston problem by Lynite Pistons.

The remarkable physical properties of the new Lynite Piston Alloy, No. 122, and the performance of Lynite Pistons in well-known cars indicate the greatest contribution to automobile engine flexibility and acceleration in a decade.

You won't want to miss this interesting story. Look for it in

The Saturday Evening Post—Dec. 16th
The Automobile —Dec. 14th
Automobile Topics —Dec. 16th

THE ALUMINUM CASTINGS COMPANY
Cleveland, Ohio

Waltham is the only automobile clock which—

—has two mainsprings
—has rewinding signal on dial
—has fifteen jewels
—is adjusted to temperature
—resists road shocks
—runs 8 days without rewinding

and

—tells the *right* time *all* the time!

Waltham Automobile Clock

Standard equipment in

Brewster
Cadillac
Cole
Crane
Detroit-Electric
Franklin
Haynes
Hudson
Locomobile
Lozier
Marmon
Mercer
Owen-Magnetic
Packard
Pierce-Arrow
Rauch & Lang
Rolls-Royce
Simplex
Stearns
Winton

WALTHAM WATCH COMPANY, WALTHAM, MASS.

THEY SAY:

Senator Harding:
"Bought one."

Cleveland Plain Dealer, 9-1-16:
"Tasty lines in the HAL TWELVE."

Bridgeport Evening Post, 9-25-16:
"HAL TWELVE will revolutionize motoring."

Cleveland Leader, 10-1-16:
"It is a car that challenges attention."

The HAL TWELVE, long, low, light and distinctive in appearance, will out-demonstrate any car built.

"There's a Reason"—The Engine.

The HAL motor is something different. Twelve cylinders — perfectly bal-

Indianapolis News, 8-5-16:

"Famous for its 'hold the road' quality."

The Washington Times, 9-4-16:

"One of the most striking."

Examiner, Chicago, Ill., 10-8-16:

"Passed everything in sight."

The Telegram, Youngstown, 10-15-16:

"The master car."

Paul Crawford, Birmingham, Ala., automobile dealer, said:

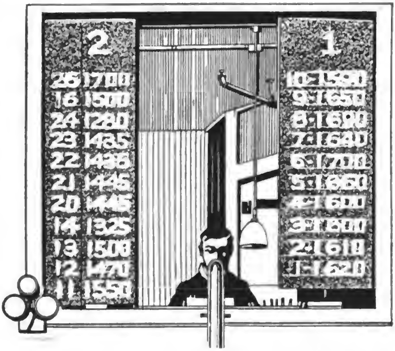
"I thought we had some hills in Birmingham, but since I have ridden in the HAL TWELVE, all roads seem to be level."

anced—a continuous flow of energy—delivering speed—power. It's the engine that makes the car—its lasting quality—its controllability—its responsiveness. It's the engine that produces get-away—hill climbing ability, and is responsible for the car's performance.

The HAL motor gives our dealers the opportunity to out-demonstrate any car built.

THE HAL MOTOR CAR COMPANY

890 East 72nd Street **Cleveland**



This Man—

has much to do in providing you with every insurance against trouble, failure and depreciation when you buy Brown-Lipe quality products.

As we have repeated frequently, your insurance against trouble, failure and depreciation is afforded by long experience and the most careful attention to manufacturing details.

BROWN-LIPE

This man, constantly in touch with the heat treating department, emphasizes graphically "the most careful attention to manufacturing details." His duty is to check every heat treating furnace every five minutes to see that the heat is brought from low point to high point regularly and steadily, and that it is maintained at just exactly the right point, with but a few degrees of temperature variation during the specified time of the heat.

The closeness with which these operations are performed is perhaps one of the most important of the manufacturing details assuring Brown-Lipe quality.

BROWN-LIPE GEAR CO.
SYRACUSE TRANSMISSIONS NEW YORK
BROWN-LIPE CHAPIN CO.
DIFFERENTIALS

NEW YORK, Thos. J. Wetzel, 29 West 42d St.
SAN FRANCISCO, A. H. Coates, 444 Market St.
CHICAGO, K. Franklin Peterson, 122 S. Michigan Ave.
DETROIT, L. D. Bolton, 2215 Dime Savings Bank Bldg.
Foreign Agent, Benjamin Whittaker, 2, Norfolk Street, Strand, LONDON, W. C.

MONROE

Two Particular Features Designate This Otherwise Conventional Quality Car as an Exceptional Selling Proposition.

Basically, the MONROE car has attained its position in the class and quality rank by refinement and development along established lines rather than by jumping to fads and fancies in search of "selling" points.

In every detail and in every part and accessory, the MONROE car embodies the very highest efficiency and quality known to present day motor car practice—irrespective of cost.

That's why, at the price of $985, the MONROE car adds distinction and prestige both to the dealer who sells it, and to the person who owns it.

PRICE TOURING CAR $985

EVERY part—motor, transmission, axles, frame, springs—represents the highest point of development yet attained in motor car construction, differing only from cars listing at twice or three times the price in size and in those points of ultra extravagance unobtainable and undesirable to the man who wants a high quality product, and yet who is unwilling or unable to pay more than $1000 for it.

You might visualize the man who buys a MONROE car as a man who pays $500 or $600 for the highest quality upright piano, either because he hasn't the room, or the money, or the desire to possess a concert grand that will cost him twice as much, and give him really no more enjoyment.

He is sold on the superior value of the highest quality upright as against the cheap clap trap piano made to sell at a price because he feels that in getting the highest quality upright he is making a wise purchase, the returns from which are really satisfactory in every detail.

In the matter of equipment, you find in the MONROE car, a Zenith carburetor; Connecticut Ignition in combination with the Auto-Lite generator; Auto-Lite starting with Bendix drive; Fedders Radiator, Cantilever springs with self-lubricating shackles; Raybestos clutch and brake lining; Stewart-Warner vacuum feed; Motometer and all the other essentials of equipment that are to be found in any car at any price.

All this is conventional in quality car practice. The two points which are really more than conventional and which show a desire and a determination to give the greatest possible value for the money, are the use of a most highly developed 4 cylinder, enbloc, valve-in-head motor and the use of an M & S locking differential in the rear axle.

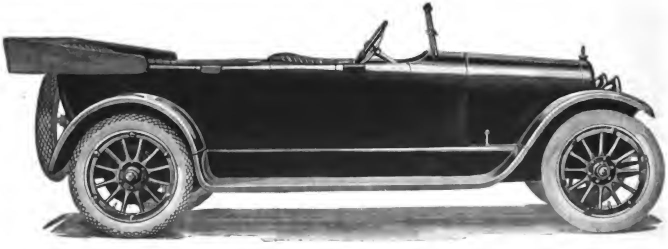
While the 4 cylinder valve-in-head motor and the locking differential are cited as dominant features of design, it is also important to know they are but three of seven engineering trends exemplified in the MONROE car.

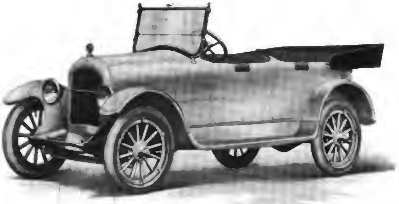
Features of Design

These trends which leading engineers, both here and abroad, freely admit as typifying advancement in motor car design and construction, and which are all present in the MONROE car may be tabulated as follows:

1. Valve-in-head motor construction.
2. The use of a highly developed and highly refined 4 cylinder motor.
3. Pressure oiling.
4. Deep frame construction.
5. Compound cantilever springs.
6. Detachable cylinder heads.
7. Equal tractive differential.

It should be borne in mind that the motor car industry has reached a point where experiments in design are minimized and where tried and true fundamental principles are being accepted more freely by the engineering brains of the industry. The trend of the times is for development along those lines which designers have felt even from the first were the right lines to pursue, and such is the trend of Monroe design.





In spite of all the hurrah and publicity of multi-cylinder motors, the fact remains that the most highly developed motor known to the automobile industry to-day is the 4 cylinder motor.

As verification of this statement, you have but to consider the fact that the accepted standard of quality in foreign practice is the 4 cylinder motor. Even the six has scarcely attained a position of importance where it is generally admitted the finest cars are constructed. Practically all of the great racing motors are 4 cylinder motors, and practically all of the valve-in-head type. So when we say to you that we are using a 4 cylinder valve-in-head type motor, we are safe in the assertion that we are following the established precedent of the producers of the highest quality cars in the world.

There never has been any question as to the superiority of the valve-in-head type motor, whether it be a 4 cylinder or a 6 cylinder.

In the early days quality manufacturers moved away from the valve-in-head type, because at that time it required more attention than the less efficient L & T head types, and was more expensive to make.

Highest Motor Efficiency

But, with the development of adjustable valves and with the discovery of the superior quality of Tungsten steel for valve construction, discarding the troublesome valve cages, the last possible objection to the valve-in-head type was removed. And any engineer who will speak truthfully will admit without question that from a standpoint of efficiency and power, the highest type of internal combustion engine is the valve-in-head type.

The Monroe motor is a 3¼" bore with 4½" stroke and a piston displacement of 150 cubic inches. The easily adjusted valves are exceedingly large.

The cam shaft is hardened and ground. The front crank shaft bearing is 1⅞" in diameter by 2 3/16" long; the rear crank shaft bearing is 2¼" in diameter by 3" long. The clutch is of the multiple disc type, using six dry plates of Raybestos and steel.

The transmission is a selective type sliding gear, three speeds forward and reverse. Nickel steel gears; double heat treated. Ball bearings used throughout. Unit power plant type.

The cooling system is of the thermo-syphon type, using Fedders radiator with auxiliary tank and with fan belt driven from the front end of the crank shaft.

The Connecticut ignition drive is from the cam shaft. The Auto-Lite Generator is belt driven. The Auto-Lite Starting Motor equipped with Bendix Drive operates on the fly-wheel.

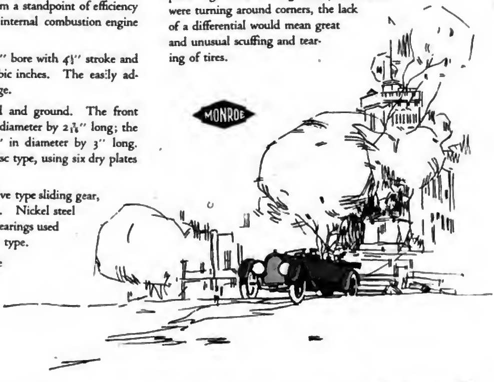
It has long been an established fact, freely admitted, that the conventional type of differential is not up to the desired standard.

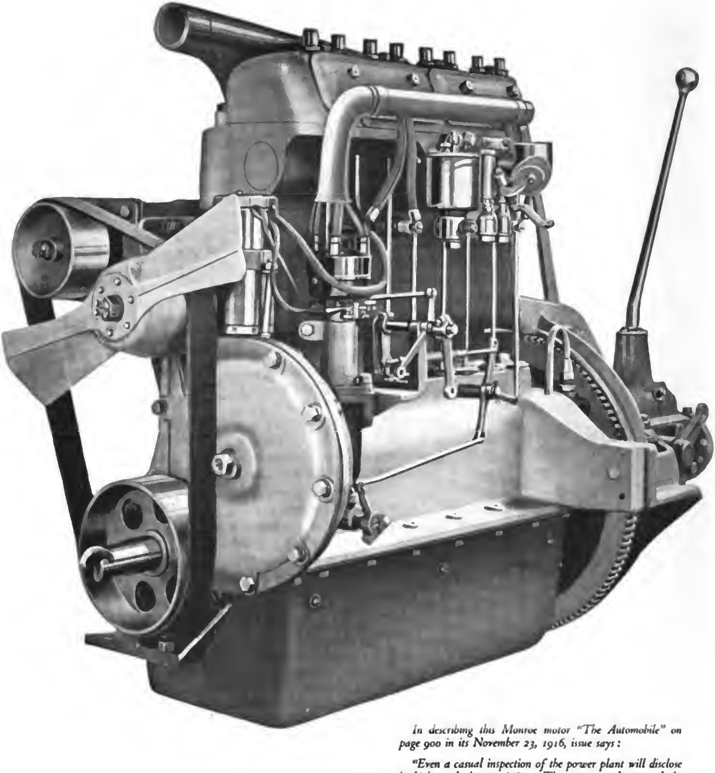
The Locking Differential

The idea of differential mechanism in the first place was based on a false estimate of the percentage of time differential action required.

When the motor car was first laid out, an impression prevailed that during a large portion of the driving period, the car would be turning away from a straight line.

Were this true, it would be impossible to operate a car without a differential, for if, during any appreciable percentage of the driving time, your wheels were turning around corners, the lack of a differential would mean great and unusual scuffing and tearing of tires.





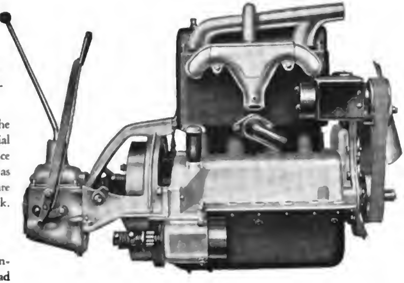
In describing this Monroe motor "The Automobile" on page 900 in its November 23, 1916, issue says:

"Even a casual inspection of the power plant will disclose its high-speed characteristics. The ports are large and the overhead valves are carried directly in the head. There are no sudden bends in the gas passages as the intake manifold is integral with the engine head.

The cylinder block is cast integrally with the upper part of the crank case. The entire combustion chamber is exposed by the removal of the upper part of the engine formed by the head casting, and the valves are also very accessible, as the push rods are carried down on the outside.

But later day investigation has shown clearly that a differential is required about ½ of 1% of the driving time. In other words, 99½% of the mileage you cover is in a straight line or so nearly straight that differential action is not required. So on this basis, the use of a differential is really unnecessary.

In fact, one of the leading truck axle makers of the country is producing rear axles without any differential whatsoever, and up to the present time, his experience has been that this elimination of the differential has caused no loss of tire mileage. However, there are drawbacks to this construction for pleasure car work.



More Tire Mileage

In the light of present conditions, the old conventional differential, paradoxical as it may sound, instead of saving your tires, is really a detriment to them.

This is true, because the greatest tire wear, due to one great shortcoming of the conventional differential, comes not in making turns, but in the spinning and whirling of one rear wheel or the other when driving over rough roads or stone pavements or on smooth roads and pavements where one wheel has better traction than the other.

It must be remembered that the conventional type of differential allows that wheel which has the lesser traction to whirl or spin many times faster than the wheel which has the better traction.

How Economy Is Effected

In driving, for instance, over a cobble stone pavement, if one wheel, or both for that matter, jump up and down away from the pavement either one or the other or both wheels instantly begin to whirl and spin at many times the speed of the car. The result is that when they again return to the surface of the road, there is a scuffing and spinning of the wheels, which materially injures the tire casing.

And what is of vaster import is the fact that this scuffing and skinning of the rubber is taking place mile in and mile out practically all the time. For the occurrence just described in driving over cobble stones is repeated on even smooth pavements that are wet.

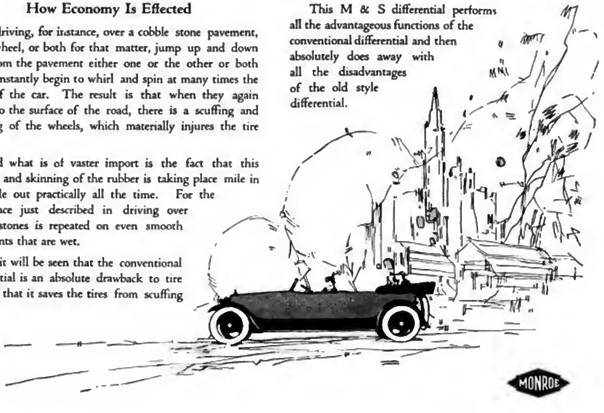
So it will be seen that the conventional differential is an absolute drawback to tire wear in that it saves the tires from scuffing only a fraction of one per cent of the time—while it actually tends to destroy the tires a very large percentage of the time.

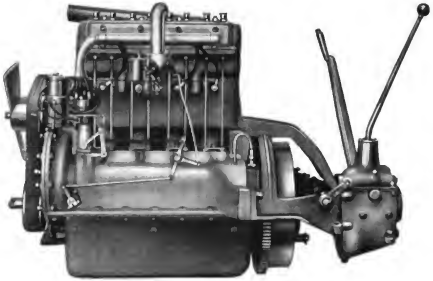
And yet differential action is of value. It enables easier handling of the car and of course does save tires in turning corners.

All of which meant that there was the necessity for improving on the old style differential.

As a result of years of tests and experiments the M & S differential became a reality.

This M & S differential performs all the advantageous functions of the conventional differential and then absolutely does away with all the disadvantages of the old style differential.





Because of its ability to prevent spinning of one wheel the M & S differential provides against skidding. Most car skidding is due initially to wheel skidding or spinning. In the MONROE car, wheel spinning is prevented so car skidding is practically prevented—for the skid is stopped before it starts.

With this differential action it is practically impossible to get stuck in the mud; for no matter how bad the hole, if one wheel has traction the car will be dragged out. Whereas with the conventional differential if only one wheel slips into the "bad going" the car is likely to be marooned, because all the driving power takes the path of least resistance and wastes itself spinning the wheel in the mud instead of exerting that power on the wheel with traction and pulling the car out of trouble.

For the M & S differential permits of perfect differential action when such action is necessary—but it positively and absolutely prevents one wheel from spinning faster than the other when traction of the driving wheels is unequal.

Additional Valuable Features

In other words, it saves your tires when you are driving over uneven or wet surfaces, where the conventional differential wears out your tires, and it also saves your tires when you are turning corners, which is the basic function of a differential.

In addition to the tire saving proposition—which has been thoroughly and practically demonstrated—the M & S differential possesses several other features of value that all add to the quality of the MONROE car.

The rear axle housing is pressed steel with nickel steel reinforcing tubes. spiral bevel gears, of course, are used to insure a very quiet reduction. Rear wheels are keyed directly to the outboard ends of the live axle shafts, thus lightening the construction but increasing its reliability.

Emphasizing the importance of a pressure oiling system, it is necessary only to call attention to the fact that the fundamental principle of oiling is to prevent metal to metal contact. In other words, to place between two pieces of metal, either or both of which are in correlated motion, a film of lubricant.

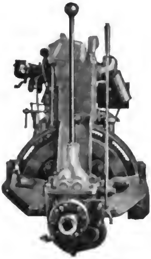
Oiling Under Pressure

Engineering development has shown that under the extreme operating conditions of a motor, the simple supplying of a dead body of oil to the necessary points is not enough to maintain this steady film of lubricant, which prevents metal to metal contact.

Only by supplying this oil at friction points under a definite predetermined pressure can this oil film be maintained.

This is very easily illustrated if you will place a small quantity of oil on a glass surface, and then forcibly strike that oil globule with your finger. This will cause the oil to fly into minute particles, leaving part of the glass covered with oil, and part of it free from oil. However, were that globule held in a definite shape by pressure from all sides, the striking it with your finger would not cause it to fly into minute globules and rob the surface of the glass of its film.

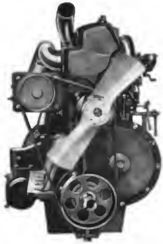
Great care and attention has been paid to the maintenance of oil under pressure in the MONROE car.



That the MONROE car is suspended with a compound cantilever spring suspension is almost apparent as one steps into the car without ever having seen the springs.

This method of suspension design is now generally admitted to be the superior construction—even though it be more expensive.

Emphasis of the fact that it is found in the MONROE car is more or less redundant.



Concerning Detachable Heads

Perhaps the simplest way to present the importance of detachable cylinder head construction is to quote from an editorial contained on page 796 of the November 9th issue of THE AUTOMOBILE entitled "Detachable Heads."

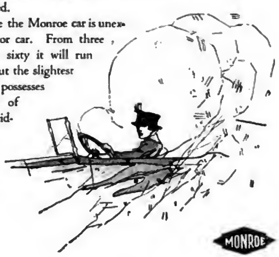
> "Engines with detachable heads are on the increase and have proved successful with very few exceptions.
>
> "The benefits to be gained from the removable head are many, both from a manufacturing and maintenance standpoint: They are an aid to accurate cylinder grinding and are valuable in that they assist the manufacturer to maintain a very narrow limit of variation on combustion chamber size. To the user they are a great boon when it comes to removing carbon or in grinding valves."

Surely this shows the up-to-dateness of MONROE construction.

There are many, many points of refinement in this MONROE car about which we could talk for hours. But we have cited a few of the essentials to indicate clearly the class and character of the car and to show that while it is built along conventional lines, it nevertheless has kept apace with all that tends toward an advancement of the art of motor car construction.

In the matter of general specifications you will find in the Monroe car genuine No. 1 leather trimmings, silk mohair top, Stewart-Warner vacuum feed, Motometer, Stewart-Warner speedometer, 8-day clock, tonneau light, wire wheels furnished at extra cost. In fact, in all that the expression implies, the Monroe car is fully equipped.

In performance the Monroe car is unexcelled by any motor car. From three miles per hour to sixty it will run quietly, and without the slightest vibration, and it possesses all those qualities of comfort and easy riding that might be expected in one of the most expensive and luxurious cars.



MONROE

MONROE

That there is a big market for such a car as this goes without saying. A market not of price nor yet of extravagance. But referring to our former simile, there are a lot of purchasers of high grade upright pianos.

There are thousands of people who want a high quality car that do not desire an extravagant car either in size, power or non-essentials. To those thousands the MONROE car has an instant appeal that its performance will more than satisfy.

The point is, are you in position to present the MONROE car to that clientele? If you are, it is a real proposition for your consideration. But bear in mind that in considering the MONROE agency, you are considering just as much a quality proposition as though it listed for $3000 instead of only $985.

It is a car that can be sold only to those people who realize what construction means and who want the best rather than the most.

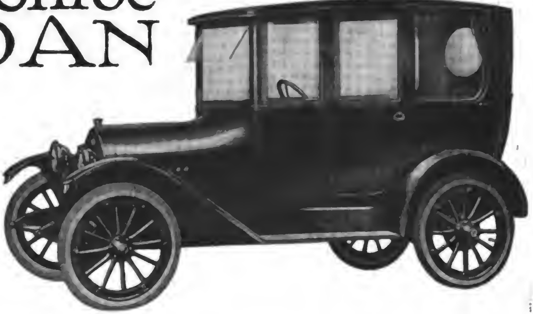
So if you are in position to handle a quality proposition, let us know what you have to offer, and we will advise you our terms and discounts.

MONROE MOTOR COMPANY

PONTIAC MICHIGAN

EXHIBITING AT BOTH NEW YORK AND CHICAGO SHOWS

The Monroe SEDAN



¶ A moderately priced, all-weather car on the Monroe Model 3 (Roadster) Chassis.

¶ In addition to the Monroe Touring Car, illustrated on the preceding eight page advertisement, the popularity and convenience of the Sedan type of body has led to the incorporation of this model in the Monroe line.

¶ Built on the smaller roadster chassis (Model 3), it has all the regular roadster equipment with the addition of larger tires. The same care and thoroughness in manufacture and in selection of materials will be found in the Sedan, together with the same conservatism in design.

¶ The Monroe Sedan, like the other Monroe Models, has a four-cylinder, valve-in-the-head motor, which, with recent improvements, is admitted to be the most efficient gas engine.

¶ Comfortably and attractively fitted up inside. Has an aisle between front seats.

¶ The Monroe Sedan with an absolutely efficient and dependable equipment, built to give the best possible service and comfortable in all weathers, is a car of the first quality.

¶ Price $965, f.o.b. Pontiac.

MONROE

MONROE MOTOR CAR COMPANY

PONTIAC :: :: :: :: :: :: :: MICHIGAN

The EMEI

EMERSON

$395 THE LOWEST PRICED 110-INCH

In this car we offer you economical up-keep combined with comfort, convenience and quality. Not the quality of an $8,000 car, to be sure, but the highest quality you can possibly obtain for the price—$395.

And that means quality that lasts, quality that keeps you on the road winter and summer, in good weather and bad, that brings you home safely and swiftly from the long ride.

Emerson parts are easily replaced, and inexpensive. Tires will last long on the EMERSON because of its longer wheelbase and easy-riding qualities, as well as its light weight.

Read the specifications—notice the improvements over cars at anywhere near this price—the higher horsepower, the selective transmission, Hyatt Bearings, semi-elliptic springs underslung, Hotchkiss Drive, honeycomb radiator, gas tank on rear, vacuum feed, Atwater-Kent Ignition.

Dealer applications have come in from all parts of the country, and we shall be ready to close agency contracts December 15th. If you haven't written yet, mail us a letter to-day. If you are the best in your territory we want you.

SPECIFICATIONS

MOTOR—The Emerson motor is four-cylinder, four-cycle, cast en-bloc, 3⅝" bore, 4" stroke, three-bearing crank shaft, 22.4 horsepower, A. L. A. M. rating.

The cylinder head is removable, giving access to the pistons and valves, being a point in favor of greater economy of upkeep. The lower crank case is so cast that the oil bottom is made of pressed steel and is removable, which gives the same accessibility to the bearings and other parts of the motor as the removable head does to the top of the motor. Bearings standard size.

The oil is circulated by flywheel and splash.

The motor is cast with a standard S. A. E. No. 5 housing, which completely encloses the flywheel and receives the transmission.

The transmission is bolted to the bell of the motor, which forms the unit power plant.

CLUTCH—The clutch is multiple disc type of the latest known successful and tried pattern, and runs in oil.

TRANSMISSION—The transmission is three speeds forward and one reverse, selective type. Shafts are of standard size. The gears standard size throughout. Bearings standard size throughout. Change gear lever directly over gears, ball and socket type of shift. Emergency brake directly alongside the cane handle shifting lever.

UNIT POWER PLANT—This type of construction, wherein the motor is connected in unit with the transmission by clutch, is the type of construction that has gained in popularity more rapidly than any other, and is today recognized as the standard, and is known as the **Unit Power Plant.** This Unit Power Plant is constructed with **three-point suspension.**

UNIVERSAL JOINTS—The double universal joint with propeller shaft between connects the unit power plant with rear axle. Both joints housed so as to retain lubricants.

AXLES—The front axle is drop forged I-beam, specially heat treated, with cup and cone bearings in front wheels. Knuckles and bolts heat treated.

The rear axle is semi-floating. Shafts are of ample size to carry the load. Standard differential, geared 4½ to 1. Bearings Hyatt, standard sizes. Ball bearings in front of pinion. Short third member. Strongly and sturdily built. Brakes 10" internal and external—act smoothly and quickly.

SPRINGS—Front—long semi-elliptic. Length 32 inches. Rear—underslung, long, very resilient, conducive to easy riding. Length 42 inches.

HOTCHKISS DRIVE—Our method of spring suspension permits us to make use of the latest, most up-to-date and simplest device known, that is, the **Hotchkiss Drive.**

STEERING GEAR—Worm and sector type. Its ease of action and control over the car is remarkable.

Left-hand drive. [Right-hand drive for export only.]

RADIATOR—Honeycomb. Sufficient capacity to insure perfect cooling.

9

RSON FOUR

EMERSON

WHEELBASE CAR IN THE WORLD $395

Main Factory, Kingston, New York

GAS TANK—On rear—capacity 10 gallons. Gasoline fed to carburetor by **vacuum system.** This location of the gas tank is only another point of comfort.

WHEELS—Front—30" x 3", clincher rims. Rear—30" x 3½", clincher rims.

These sizes are standardized by other large producers of cars.

FRAME—Pressed steel, of sufficient dimensions to form the foundation on which to install our other valuable and up-to-date features, and is of strength sufficient to withstand all conditions the car may be subjected to.

LAMPS—Electric, two heads and tail, with dimmer attachment.

ELECTRIC EQUIPMENT—Generator on front right-hand side of the motor, gear driven. **[Starter left rear side of motor. Very readily attached when ordered as an extra.]**

IGNITION—Atwater Kent distributor.

BATTERY—Wet storage.

CARBURETOR—Standard float feed.

WHEELBASE—110 inches.

TREAD—Standard 56" only.

ROAD CLEARANCE—9¼ inches.

BODY—In the further carrying out of our ideas we have designed a neat full stream line body, the symmetry of the lines melting into each other from the honeycomb radiator to front to the rear.

The rear seat is very roomy as to width and leg room as well as the front seat.

TOP—One-man.

FINISH—Black and nickel; no option.

TRIMMINGS—Imitation leather.

FENDERS—Last, but not least, we deck this chassis with a set of beautifully mounted and snappy crown fenders.

EQUIPMENT—Electric horn, tool kit, tire repair kit, jack and pump.

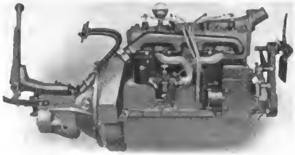
APPOINTMENTS—The car as a whole with its up-to-date and standard chassis—full stream line body—with slanting windshield and one-man top—with weight of approximately 1,800 pounds—gives to the consumer a snappy car that is pleasing to the eye, and satisfactory to the last degree in action on the road. **The EMERSON "FOUR" is the car long sought after.** With a distinctiveness all its own—with its marvelous economy in all respects (as to gas, oil, tires and upkeep)—its ease of control—its wonderful hill-climbing propensities—its easy riding qualities—these make it the popular car that it is.

PRICE—$395.00 F. O. B. factory.

$470.00 F. O. B. factory equipped with electric starter, speedometer and tire carrier.

The above are guaranteed to be the exact specifications of the Emerson "Four," but, of course, the right is reserved to make such refinements and changes as may be deemed advantageous to the product. The standard guarantee of the National Automobile Chamber of Commerce, Inc., applies to every Emerson "Four."

Dealer applications are arriving with every mail, and we shall be ready to close agency contracts beginning December 15th. Hadn't you better write us today?



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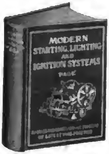

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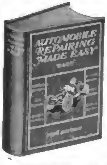

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Ignition is a puzzle to the majority of car owners — hence when ignition fails the car is useless and the owner becomes discouraged with his purchase—the car maker loses, the agent loses, the owner loses.

Has the car maker given as much thought to the ignition system as he might, has he tried to save money at the customer's expense, has he considered the many advantages of a good magneto, has he saved wisely by using something other than a magneto? These are questions; vital questions.

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It should not be hitched to the lighting system or the starting system.

It should not depend upon the battery, which itself has to depend upon the dynamo and the possible thoughtfulness of the driver.

It should be free and alone.

Having Bosch Magneto Ignition, a car has reliable ignition, ignition that is world renowned, and that depends upon itself alone for its reliability.

Correspondence is invited on the ignition subject. Catalogues sent on request

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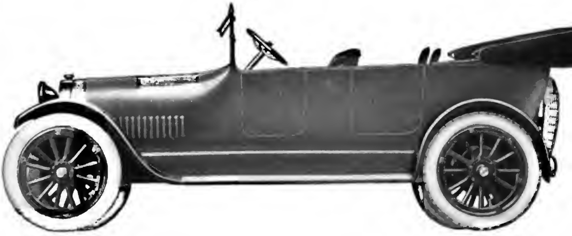

The New SERIES 18 Studebaker Cars

With Seven New and Exclusive Features

Studebaker

The Day of High Prices for Fine Cars has Passed

The new Studebaker SERIES 18 cars, with seven new, special and exclusive improvements are FINE CARS warranted by us to completely satisfy the most particular and fastidious persons. We believe these cars represent the greatest automobile values ever offered to the buying public, and that persons accustomed to paying $2,000 or $3,000 for cars will, upon examination, concede that these Studebakers equal ANY such cars in quality of material, design, workmanship and finish.

These new SERIES 18 Cars offer the most wonderful opportunity that Studebaker dealers have ever had, and it is a matter of record in the automobile market that Studebaker dealers have always enjoyed the highest prosperity that merchants of motor cars have witnessed in any year. The value, the prices, the size, power and exceptional quality of these Studebaker cars are so self-evident that we know every Studebaker dealer will agree with us that this new SERIES 18

STUDEBAKER has centered its great resources and experience on ONE BASIC DESIGN with all parts interchangeable for both the FOUR and SIX, except the motor. One equipment of machinery, tools, character of manufacturing operations and quality of material suffices for both models.

No revolutionary changes have been made in the basic Studebaker design for four years. The same group of EMINENT ENGINEERS AND DESIGNERS are responsible for the evolution of the new SERIES 18 models, yet the many improvements and refinements adopted as the result of our experience have made these new models decidedly the best cars we have ever produced. They are sold with our guarantee of prompt and efficient service and the replacement without charge of defective parts, if any are developed, within one year from date of sale. We guarantee our cars to give absolute satisfaction, provided they receive the care a highly developed piece of machinery should receive.

The SERIES 18 cars are leaders in the industry, history makers, which put Studebaker in the lead with new and greater values at popular prices. Studebaker has led the way in nearly every forward step in automobile construction in which the owner profited. STUDEBAKER WAS THE FIRST

—to produce a six-cylinder car selling for less than $2,000;

—to produce a 50 horse power car selling for less than $2,000;

—to produce a seven-passenger car selling for less than $1,000;

—to establish a uniform, international service system for owners;

—to produce the now popular crown fenders;

—and, finally, Studebaker was the first manufacturer of FINE CARS to offer its product at medium prices, thus leading the way to greater values and compelling other manufacturers to increase values and reduce prices.

Studebaker has $13,000,000 invested in the most efficient and modern plants, in which it manufactures all of its engines, axles, transmissions, differentials, bodies and tops. Middlemen's profits (parts makers) included in the price of assembled cars and small manufacturers' cars are almost entirely eliminated in Studebaker selling prices. It is necessary to pay from 50% to 100% more than Studebaker prices for cars of corresponding value.

SEVEN NEW IMPROVEMENTS AND ADDITIONS

Gun-Metal Finish. Original, rich and exclusive finish of deep lustre and permanency, applied in twenty-five operations. No finer finish is possible than that of the SERIES 18 Cars. A permanent body finish depends largely on the slow and careful building up of the different coats of color and varnish — the Studebaker way. Fenders and aprons are rich, black enamel.

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40 H. P. 7 Passenger Four Touring Car $940
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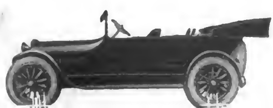

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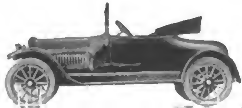

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comfortable seats are to be found in any car, regardless of price.

New Storm Curtains. Of the recent Blackmore design and patent, opening with the doors and thereby preventing crouching and crushed hats. Studebaker, we believe, is the first maker to offer this improvement as standard equipment.

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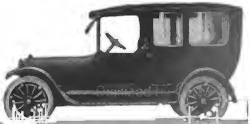
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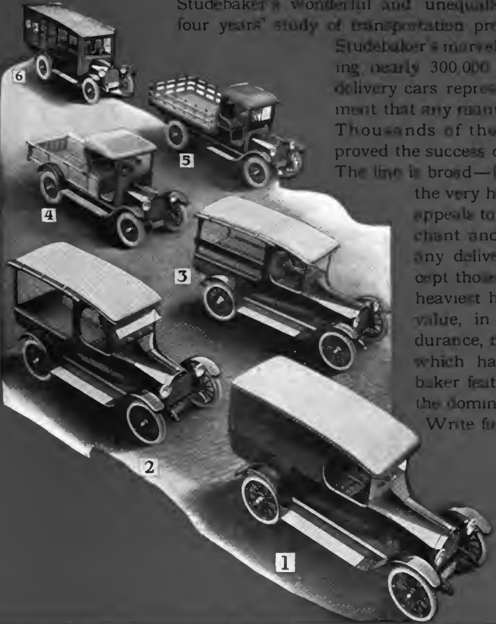
Every one the leader of its class in price and value

There is a great business-building opportunity for constructive men in the Studebaker line of commercial cars. Based upon Studebaker's wonderful and unequalled experience of sixty-four years' study of transportation problems, and based upon Studebaker's marvelous experience of producing nearly 300,000 automobiles, Studebaker delivery cars represent the highest achievement that any manufacturer has yet offered. Thousands of them in actual use have proved the success of the Studebaker design. The line is broad—including everything but the very heaviest types of truck. It appeals to every business man, merchant and manufacturer who has any delivery problem to solve, except those concerned with the very heaviest hauling; and in price, in value, in size, capacity and endurance, not to mention economy which has always been a Studebaker feature, these cars are easily the dominant values of the market. Write for full information.



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1. Panel Delivery Car	$ 875
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Prices on all half-ton models will advance $50 January 1st

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YOUR CAR AWAY—IF IT IS

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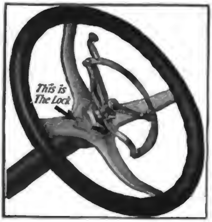

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Why take out other kinds of insurance—accident and fire—and park your valuable car where it can be easily stolen?

The "Perry" Auto Lock can be attached to any make of car in 15 minutes—it does not interfere with nor change any of the standard parts of the Steering Gear—your car is absolutely safe to drive at all times. It's impossible to drive or tow away a "Perry" locked car, because when locked the Steering Wheel has no connection with the Steering Post—the front wheels of the car are wild. The "Perry" is right at your finger tips on the Steering Wheel—no bending and stooping—nothing to get out of order—no charge for installation—lasts a life time—can be changed to any car you may buy in the future.

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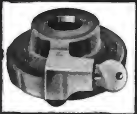

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The largest Ford Accessory distributor in the United States says the "Perry" is the quickest selling, the most satisfactory and profitable device he ever handled—name upon request.

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Gentlemen:—I own a.................. ....car Send me a Descriptive Folder and give me name of nearest dealer—I am interested. No obligation on my part.

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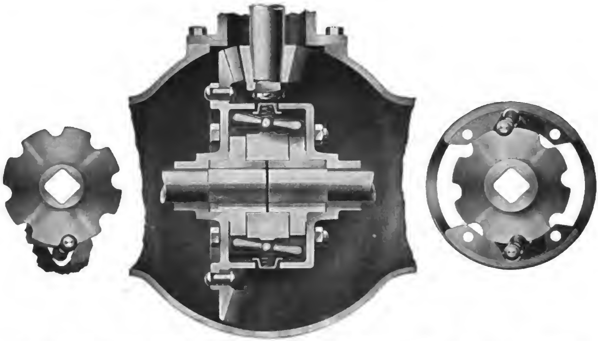
Tomorrow YOUR Ford may be stolen



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CAR AND AXLE BUILDERS:

How much longer can you afford to close your eyes to the benefits of the New Process Gearless Differential?—the correct operating principle that lessens noise, wear, swerving, skidding, useless grind and side thrust on the tires.

Careful investigation of the New Process Gearless Differential would convince you that it offers decided improvement over the gear differential and has a simplicity and strength that assure constant and continued satisfaction.

You can make the change without altering your present axle housing and bearing layout, and we will back you with any reasonable service guarantee.

Licensed under patents of the
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125a

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"Not the name of a thing, but the mark of a service"

Instead of one manufacturer's spasmodic development of his product, MAZDA Service substitutes a systematic, all-inclusive study of incandescent electric lamps for several manufacturers.

The Meaning of Mazda

MAZDA is the trademark of a world-wide service to certain lamp manufacturers. Its purpose is to collect and select scientific and practical information concerning progress and developments in the art of incandescent lamp manufacturing and to distribute this information to the companies entitled to receive this Service. MAZDA Service is centered in the Research Laboratories of the General Electric Company at Schenectady.

The mark MAZDA can appear only on lamps which meet the standards of MAZDA Service. It is thus an assurance of quality. This trademark is the property of the General Electric Company.

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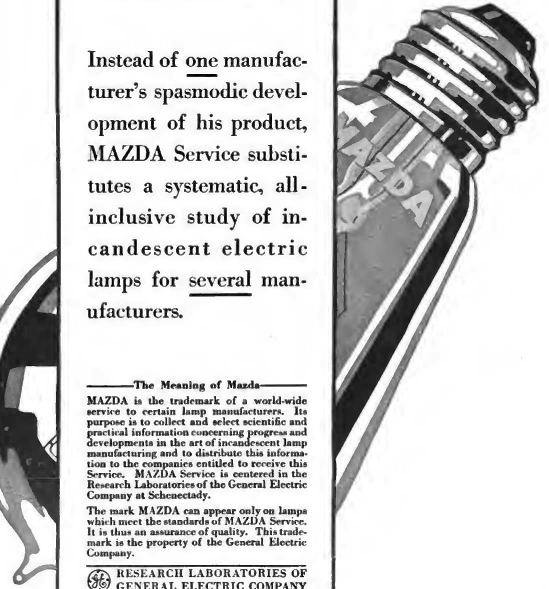

Republic Prodium Process Rubber breaks all records

The most valuable contribution to pneumatic tires during the past year was Republic Prodium Process Rubber.

The public has been quick to appreciate this wonderful discovery, and for the past twelve months the sale of Republic Tires has been so great that, even with doubled output, at no time were we able to meet the demand.

Our best sales records have been smashed by this master tire.

In the service of owners Republic Tires have given mileage that in many cases was almost unbelievable. Our highest expectations have been surpassed by this actual performance of Republic Prodium Process Rubber.

Dealers, too, have experienced a boom in the sale of Republic Tires that is unprecedented in the tire industry. Agents who had failed to made ordinary tires pay have built profitable businesses with the new Republics.

Our 1917 plans cover an increase in our production of 150% —this with our tremendous advertising and selling campaign should be of vital interest to you.

As a tire dealer, Republic Tires deserve your most serious consideration. For dealers' discounts and selling proposition write or wire.

The Republic Rubber Company, Youngstown, O.

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OWEN MAGNETIC

THE Owen Magnetic gives you a fluid smoothness of riding beyond other cars. It gives you a range of driving manipulation as wide, as free, as a musical note—a range far beyond other cars.

It stays YOUNG, it stays NEW, in a measure impossible to other cars.

It saves power waste.

It saves tires.

It saves parts.

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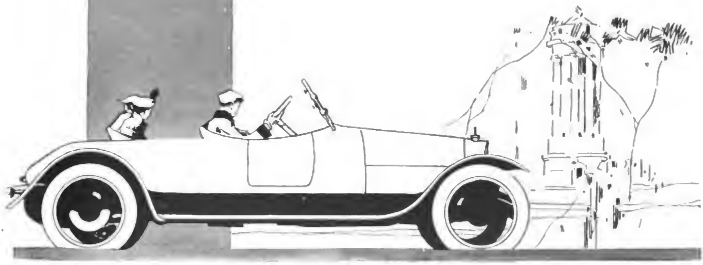
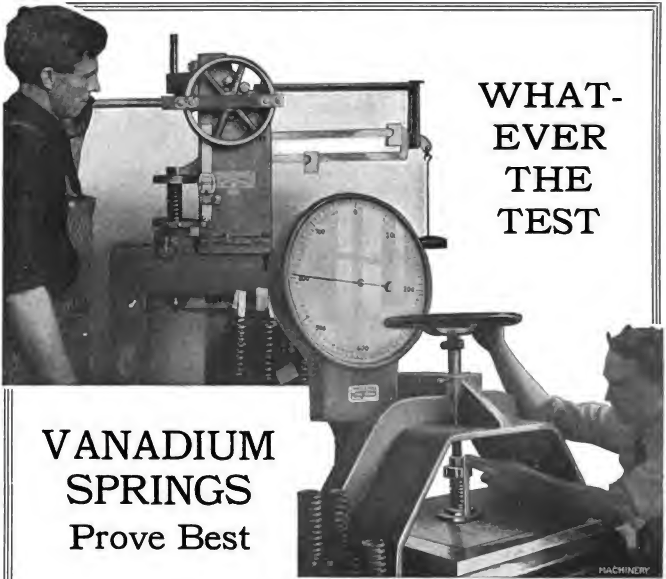
It reduces complications.

It has no clutch to operate.

The Story of HOW this is and WHY, is too important for you to miss. It is told in the Dec. 28 issue of this magazine. Watch for it. Or let us send you a personal copy of the story. We will value the request from you very highly.

Baker R&L Company
CLEVELAND OHIO
Manufacturers of
Owen Magnetic Motor Cars
Salesrooms
New York-Boston-Philadelphia-Chicago





WHAT-EVER THE TEST

VANADIUM SPRINGS
Prove Best

Here, for instance, are two different tests, by different manufacturers.

In that in the upper illustration, the Raymond Manufacturing Co. tested to destruction springs of vanadium steel and another well-known alloy spring steel, with this result—Under 15% higher fibre stress the vanadium springs stood 40% more compressions.

The lower illustration shows the regular "bump" test made by the K-W Ignition Co. of K-W shock absorber springs. Fifty thousand compressions without set is required. Out of hundreds of thousands of vanadium springs only 3% have failed to pass, while 99% of the carbon steel springs tried fell down.

American Vanadium Company

New York Pittsburgh London

Every Model in this Reo Line Has Proved a "Best Seller"

THERE ISN'T A MODEL in that whole array of eight Reos but is the leader in its class.

EVERY ONE—EVERY SINGLE ONE "The Gold Standard of Value" in its price and capacity class.

THERE ISN'T A "slow mover" in the Reo line. Not one model that cannot and does not stand on its own footing. Not one that wouldn't be a leader were there no other Reo.

YOU KNOW WHAT IT MEANS to have to take a certain number of slow sellers in order to get another model that, for the time, has the call.

THAT HAS BEEN SHOWN us most forcibly from time to time when the factory got a little behind on one model or another and we couldn't ship "mixed car lots" to dealers.

NO MATTER WHICH—a Four or a Six; Roadster or Touring car; Closed car or Truck;—seemed as if the demand for one was as insistent as for another.

IN A WORD, REO stands on its own legs so to speak.

THAT'S AN IDEAL LINE from the dealer's standpoint. No need to tell you that. You know it.

AND THAT'S WHY 80 per cent of those distributors and dealers who handle this line, handle Reos exclusively—and handle the whole line.

AND THEY MAKE MONEY, those exclusive Reo representatives.

NO NEED TO TELL YOU that either, for you know it. The Reo man is the envy of automobile row in every city.

JUST AT THIS WRITING our problem is to supply present Reo dealers the cars and trucks they need to fill orders. And we seldom change.

BUT YOU NEVER CAN TELL—once in a great while we find it necessary to change—perhaps to get an exclusive dealer where our representative is now trying tolive up to two religions.

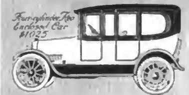
ONLY WAY, IF YOU WOULD secure the Reo line some day, is to keep in touch—write the Sales Manager in strict confidence—get in line for the Reo Line—and wait!

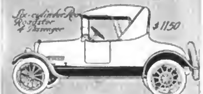
Reo Motor Car Company

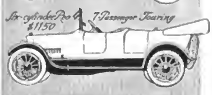
LANSING, MICHIGAN

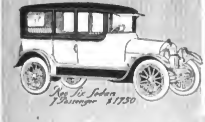
173-A

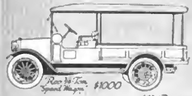
Reo the Fifth 5 Passenger Touring
$875

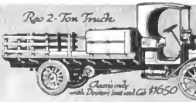











Reo 2-Ton Truck
Chassis only with Driver's Seat and Cab $1650

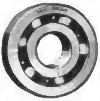
All Prices are f.o.b. Lansing Michigan

"THE GOLD STANDARD OF VALUES"

"Hess-Bright's Conrad Patents are Thoroughly Adjudicated"

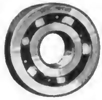
HESS-BRIGHT BALL BEARINGS

TRADE MARK
HB DWF
HESS-BRIGHT
THE INIMITABLE BEARING



THE HESS-BRIGHT BEARING meets every condition of load and speed and every requirement as to accuracy and silent operation, in a manner unequaled in other bearings.

It is the STANDARD OF EXCELLENCE and exemplifies the exceedingly high standard of the Hess-Bright organization.



THE HESS-BRIGHT MANUFACTURING CO.

PHILADELPHIA, PA.

"The Greatest Truck ever presented to the American Public" —*William F. Melhuish, Jr.*

I have produced a one-ton truck chassis to sell at $1000.

I have brought together a company strongly intrenched financially to manufacture this truck in a great, big way. I have gathered about me one of the most efficient and powerful truck-manufacturing organizations with which it has ever been my privilege to be connected.

The company has purchased an extensive tract of land at Farmingdale, Long Island, just outside New York City's limits, and has erected thereon spacious, new, saw-tooth, daylight factory buildings. Production is now going forward on a building schedule of 1,000 trucks for 1917 delivery.

Those who have known me in the trade for the past fourteen years, and particularly during my connection with the largest truck factory in America, handling exclusively high-priced and finely built trucks, know that I know the truck business—know what constitutes a first class truck — know what a truck must deliver — know what the public wants.

I have known for years that the public demand is for a modest-priced truck—one that will deliver the goods and stand up under all road conditions, yes, but one that is priced within the reach of the average business man. I had this constantly thrust home to me as I met the dealers handling high-priced trucks.

Finally, I made up my mind that I would build just such a truck, take a very small manufacturing profit and let quantity production put my company on the map in a great, big way.

And so I have built the Ful-ton One-Ton Truck to sell at $1000—the first 1 to 1½-ton job to be put on the market at this phenomenally low price. Temporarily the price will be $1090, but we will lower the price just as soon as quantity production increases and materials get back to somewhere near their normal prices.

I have built an all-purpose "tonner" which we propose shall be a "*go-everywhere*," "*do-everything*" truck. I have given it dual rear wheels so that it can and will *go everywhere* that a ton load can be expected to go. I have given it a 9-foot loading platform so that it can be the *do everything* truck. I have provided a 134-inch wheelbase and a power plant that develops 30-horse, with a gear ratio of 7½ to 1. I have built this truck on the "huskiest" frame you have ever seen in a ton job—5 1/16 x 2½ x 3/16 inches. And under it stands an internal gear drive rear axle—the axle that every heavy truck manufacturer will eventually adopt if he follows the best engineering practice—the axle that competent engineers say has been ahead of its time for the past two years.

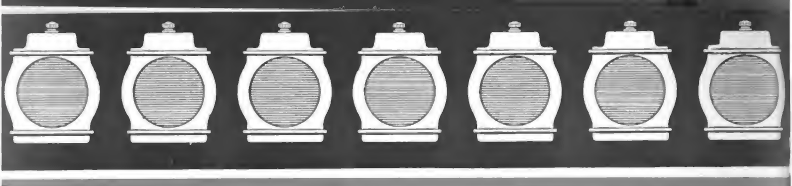
I have put *selling features* into this truck — solid, common sense features — that the public will see at a glance.

I might tell you more, but you must see the truck and go over it inch by inch — part by part — to appreciate its sterling qualities. You will want to sell this truck after you have seen it, and I don't believe you will want to "buck" the competition it will give you if it is allotted to some wide-awake agency other than your own.

We are closing territorial contracts now and I strongly urge you to wire me, or better still, get aboard the train and come to Farmingdale if you want to sell Ful-ton Trucks. When you arrive you will find yourself in touch with the *livest* bunch of truck men you have met in a long, long time, and you will quickly become convinced that we have *the goods*, and the ability to deliver them.

Offices and Factory
Farmingdale, L. I., N. Y.

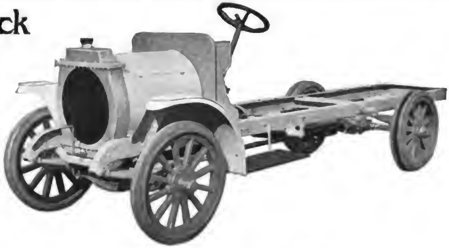
WM. F. MELHUISH, Jr., *President*
CLYDE MOTOR TRUCK COMPANY



Ful-ton Truck

1-1½ ton

$1090



The Ful-ton Truck Specifications

CAPACITY: 2,000 to 3,000 lbs.

MOTOR: Four cylinder, 3¾-inch bore, 4½-inch stroke, L head type cast en bloc, 22.5 H. P.—S. A. E. rating.

COOLING: Ful-ton, exclusive design radiator, in front of hood, allowing use of 20-inch fan giving positive cooling in any climate.

CARBURETOR: Automatic, float feed, hot air quick-starting device.

IGNITION: Eisemann high tension magneto with set spark.

LUBRICATION: Combination pump and splash system. Designed especially for heavy duty motors.

CLUTCH: Multiple disc dry plate. A unit with motor and transmission but very accessible.

SPRINGS: Special Ful-ton design. Front springs, semi-elliptic, 42 inches long, 2¼ inches wide. Rear springs, semi-elliptic, three-point shackle suspension, 50 inches long, 2½ inches wide. All springs are heavily bushed.

BRAKES: Emergency brakes 13½ inches in diameter, 2 inches wide, operated by hand lever. Service brakes 14 inches diameter, 2½ inches wide, operated by foot pedal. All brakes applied direct to rear wheels.

FRAME: Ful-ton special design, heat treated steel channel section 5 1/16 inches by 2½ inches by 3/16 inches. Extra heavy, designed to carry 50% overload.

AXLES: Front axle drop forged I beam section, heat-treated steel, heavy steering knuckle spindle, with tie road mounted aft and 10-inch road clearance. Rear axle, Daimler internal gear design, with heavy I beam carrying the load. All power is transmitted directly to the driving axle with minimum loss. This type of construction is the very latest engineering practice.

WHEELS: Front, 34 x 3½ inches, having twelve extra heavy spokes and mounted on roller bearings. Rear, dual 34 x 2½ inches, having twelve extra heavy spokes and mounted on heavy duty roller bearings.

WHEEL BASE: 134 inches, standard tread and allowing short turning radius.

STEERING GEAR: Screw and nut irreversible with 18-inch wheel. Left side drive for American; right side for export.

GASOLINE TANK: 14-gallon capacity.

TIRES: 34x3½-inch front, 34x2½ dual, rear; solid rubber. Pneumatic, furnished at nominal extra cost.

DIMENSIONS: Standard chassis over all, 200 inches. Distance from back of seat to end of frame, 9 feet.

EQUIPMENT: Horn, 2 side lamps and rear tail lamp, tool kit and jack.
Blueprint of chassis furnished to all body builders.

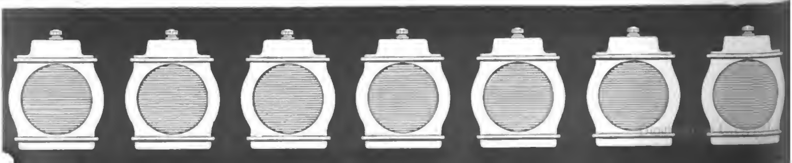
Ful-ton trucks are adaptable for every form of delivery service, freight haulage, sightseeing, etc.

Price, Chassis $1,090 F. O. B. Factory, in New York City. Packing extra at cost.

Clyde Motor Truck Company

Farmingdale–Long Island–New York

This Company has no Connection with any Other Firm or Corporation Using the Name Clyde.



Accuracy

maintained in automobile production and repair service by the use of

TRADE MARK

Starrett Tools

REG. U.S. PAT. OFF.

Whatever your interest in automobiles—whether you are an engineer, manufacturer, superintendent, or garage owner, you will find that Starrett Tools are the most practical and efficient instruments for maintaining accuracy in mechanical work. They are used in practically every toolroom and shop in the country, devoted to the production or repair of automobiles.

From the laying out and making of fine dies and jigs for duplicate production to the inspection of finished parts in the factory; and for all kinds of measuring on service work, these tools are indispensable. With a line of 2100 styles and sizes to select from, there are tools that the manufacturer should place in his toolroom for shop standards; other tools that should be furnished the inspection department, and others that the individual machinist should have as part of his kit.

The line includes steel tapes, rules, squares, levels, calipers, dividers, micrometers, vernier calipers, height gages, surface gages, tap, thread and drill gages, etc.

We will send free to any engineer, executive or machinist our 342 page catalog No. 21 FH, describing the full line.

The L. S. Starrett Co.

THE WORLD'S GREATEST TOOLMAKERS

Athol, Mass.

42-580

Atwater Kent *Ignition*

Hupmobile at Washington ***Monument,*** *Philadelphia*

Atwater Kent Ignition is regular equipment on the Hupmobile—an evidence of the high ideals and rigid requirements of its manufacturers.

Dealers and repair men are selling thousands of Atwater Kent Systems for magneto replacement on cars of all makes.

Correspondence is solicited from the trade and from car owners.

ATWATER KENT
MFG. WORKS,
Philadelphia

JOHNS-MANVILLE SERVICE

COVERS THE CONTINENT

Just one thing more—your help—and a big year for NON-BURN lies ahead

BUT before we look ahead, let's look back—to see what a quarter century has done toward perfecting lining; and then what has grown from all this, in a sales policy that builds demand and makes reputations for dealers.

¶ For years we have been making brake linings. Before the motor car came, we fashioned asbestos rock into brakes for big industrial cranes and derricks. We learned the secret of making them safe under heavy loads — sure-gripping in spite of oil or grease, and long-wearing in the severest service. To turn to automobile brakes was simple, for we held the key: Selection of suitable ASBESTOS fibre.

¶ It's the fibre that makes the lining, and ASBESTOS fibres vary — those suitable for paper or for shingles may lack the fibre length or tensile strength required for linings. But for a matter of a half-century Johns-Manville has led in ASBESTOS production and manufacture; with our outlets for every grade of fibre we can afford to pick and choose — to employ, without wastage, just the grade of asbestos that the service demands. And into NON-BURN go only *selected* fibres from our finest mines. That's why it wears—why more and more motorists are finding it safe, dependable and economical. They probably don't know it's a matter of fibre — but they do know that NON-BURN *serves,* and they pass the good word along.

¶ So with a product that's right, with our own sources of raw material, and with an output largely increased by new equipment, we are prepared to make NON-BURN a familiar word in the accessory field next year. And to that end, seeking your cooperation, we have worked out a sales policy which will satisfy your requirements as completely as the lining satisfies your customers.

¶ J-M NON-BURN will be sold only through established classified trade channels and jobbers' and dealers' margins will be rigidly maintained. There will be no quantity discount, so without sacrifice of profit you can avoid tying up capital in large stocks. And to move the stock from your shelves, Johns-Manville plans for next year the most extensive advertising campaign ever adopted to sell brake lining. This means quick turnovers and protected profits—good business on the soundest basis possible.

¶ All in all, it's a proposition which deserves any dealer's attention, and there'll never be a better time than the present for getting in on the ground floor. We will gladly send details to any dealers interested.

J-M NON-BURN

H. W. JOHNS-MANVILLE CO., Branches in 54 Large Cities Executive Offices, 296 Madison Ave., N. Y.

Columbia Grafonola

THE minstrels who sang of the "tidings of great joy" in the days of long ago are supplanted by the minstrels of modern days—the Columbia Grafonola, with Columbia Double-Disc Records.

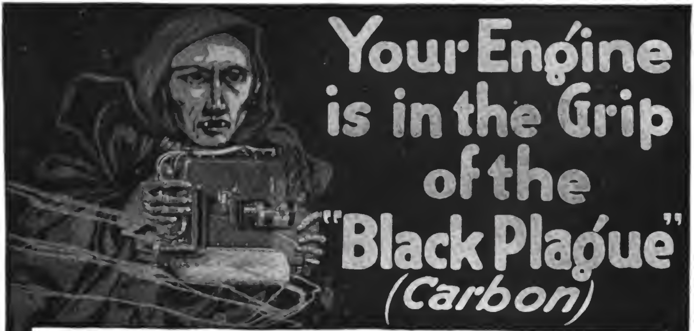
The Columbia Grafonola truly brings "tidings of great joy" at Christmastide. There is no gift quite like it, no gift so welcome, no gift that could bring a more *lasting* joy.

Give *music* this Christmas—a Columbia Grafonola; or an appropriate assortment of Columbia Records to owners of instruments. Your dealer will gladly help you select them—and he has records to suit every taste. You know what your friends and your family like, so you can easily solve the gift question for all at your Columbia dealer's *today*.

New Columbia Records on sale the 20th of every month

The instrument illustrated above is the $200 Grafonola
Prices in Canada plus duty

Columbia
Columbia Records
Trade Mark
Note the Notes


Your Engine is in the Grip of the "Black Plague" (Carbon)

THAT'S the principal reason your car starts so hard this cold weather. After two or three thousand miles the lungs of even the best designed motor are so thoroughly encrusted with the black deposit that you can't expect engine efficiency or fuel economy. The most annoying effect of carbon in winter is the difficulty in starting the motor—80% of your starting trouble can be eliminated if you will clean out your cylinders with

JOHNSON'S CARBON REMOVER

This is the latest and most perfect solution of the carbon problem. It is easy to use—inexpensive and absolutely harmless. It will save you ten times its cost every time you use it.

DO IT YOURSELF

Five minutes time and no labor required. Simply lift your hood and pour an ounce of Johnson's Carbon Remover into each cylinder through the petcocks or spark plug openings. Go to bed—get up in the morning and drive a perfectly clean engine. You can save from $3.00 to $5.00 over any other method without loss of time and with very much better results.

USE IT EVERY 1000 MILES

If you will use Johnson's Carbon Remover every 1000 miles you can keep your engine clean and sweet and always at its highest efficiency and your gasoline consumption will drop from 12% to 25%.

PATENT APPLIED FOR

S. C. JOHNSON & SON, DEPT. A. **Racine, Wis.**
LONDON SYDNEY

OUR GUARANTEE

No matter how much you use or how you use, it Johnson's Carbon Remover cannot injure any part of your motor. It contains no acids—does not in any way affect lubrication or injure the oil in the crank case. It has no action on any metal. If your dealer cannot supply you use the attached coupon.

S. C. JOHNSON & SON, Dept. A, Racine, Wis.

I enclose $1.00 for which please send me by prepaid express enough Johnson's Guaranteed Carbon Remover to thoroughly clean an ordinary four cylinder motor three times.

Name ....
Address ....
City and State ....
My Dealer is ....

The BOUND BROOK OIL-LESS BEARING COMPANY make two different kinds of Oil-less Bushings. One kind is made of high grade bronze, so designed and constructed as to retain lubricating graphite. It is known as "Bound Brook."

The other is a hard wood bushing, impregnated with lubricant and is known as "Nigrum."

The process by which both "Nigrum" and "Bound Brook" bushings are made is covered by basic patents, and these bushings are everywhere known as "Genuine Graphited Oil-less Bushings."

All Mack Trucks are equipped with Genuine Graphited Oil-less Bushings

—equally efficient for light or heavy duty

Consider, please, this huge, ponderous seven-ton Mack Truck.

Big firms buy it to reduce their hauling expense and to insure *quick* deliveries.

Consequently The International Motors Company incorporate in their Truck only such integral parts as will stand up and deliver non-interrupted service *in spite of abnormal strain, neglect and even abuse.*

Here engineering science demands that wherever wear comes, only super-fine units shall be used.

And there in a nutshell you have the reason why Genuine Graphited Oil-less bushings are used in certain places in all Mack Trucks.

Genuine oil-less bushings need no oiling. They remain long-lived, smooth running and fully efficient without lubricating attention. They contain within themselves sufficient lubrication to last their life-time.

—and the ANDERSON ELECTRIC.

You will never think that this business-like little luxury car, built with the precision of a watch and as quiet and smooth running could ever have anything in common with one of the biggest and most powerful motor trucks built today.

Yet you will find in the Anderson Electric the same Trouble-less, less-Cost, Oil-less bushings that you find in the Mack Truck.

For these bushings insure quiet, smooth-running and longer life. *They are equally efficient for light or heavy duty.*

You will find them incorporated in nearly all of America's Quality Built Pleasure Cars and Trucks as well as in machinery of all kinds throughout the world.

All Anderson Electrics are equipped with Genuine Graphited Oil-less Bushings

Bound Brook Oil-less Bearing Company

Bound Brook, N. J.

The Foundation of United Service

An Efficient Organization
and Modern Equipment

THIS pictures the new 8-in. Morgan Semi-Continuous Bar Mill which we have recently placed in operation.

Like all our new equipment it is of the most modern type. Experts have pronounced it the finest mill of its kind in the world.

On this mill, built especially to finish alloy steels, the bars are brought down through 14 passes to a true size; the steel, thoroughly and evenly worked, leaves the mill with an exceptional finish. With mills electrically equipped—in a light clean building—the equipment and the surroundings are in keeping with the standards of manufacture of "United" Alloy Steels.

Chrome Vanadium
Special Analysis
Chrome Nickel
Nickel
Chrome
Magnet
Silico Manganese
Chrome Silico Manganese

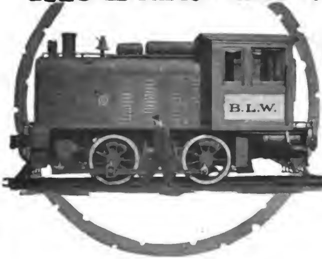
UNITED ALLOY STEEL CORPORATION

Successors to
The United Steel Company

Basic Open Hearth *Heroult Electric*

CANTON, OHIO

PHILBRIN IGNITION SYSTEMS
· adopted by ·
The Baldwin Locomotive Works



*The Baldwin Locomotive Works of Philadelphia after thorough tests of some of the best known ignition systems in the world adopted **the Philbrin Duplex** for use on their gasoline-motor locomotives.*

*The use of the Philbrin **ignition on** these locomotives has:*

*reduced gasoline **consumption tremendously.***

greatly increased power.

*improved the acceleration, **flexibility and general running of the** motor to a surprising **degree.***

The most difficult problem for an ignition system is the successful and economical operation of a huge slow-speed motor such as is used in gasoline locomotives

Philbrin has successfully solved this most difficult problem and is doing the same thing with all other ignition problems, from the slowest to the highest speed motors.

We have succeeded where others have failed.

The simplicity, accuracy and special design gives success to the Philbrin system wherever it is tried.

Put the Philbrin Duplex ignition to any motor test you wish:

honestly compare its performance with that of any other ignition system you have ever seen, your conclusion like that of the Baldwin Locomotive Works will be decidedly in favor of the Philbrin.

Results are what the Baldwin Locomotive Works wanted. It is what every manufacturer and car owner wants. It is what the Philbrin produces.

The Philbrin ignition accomplishes wonders. It meets perfectly all motor demands, overcoming the difficulties of:
—starting in cold weather.
—fouled spark plugs.
—faulty carburetor adjustments.
—low grade fuel.
—carbonized cylinders.

The Philbrin System
—positively reduces gasoline consumption.
—produces greater power.
—gives greater flexibility, quickness and smoothness of running.
—insures against ignition failure.

Having no complicated and intricate working parts the Duplex system is practically fool-proof. Electrically and mechanically simplified and perfected to the last degree the system gives

Maximum Power with a Minimum Current and Gasoline Consumption.

Practically nothing to get out of order, no ignition worries to meet—it will outlive your car.

The Philbrin systems are quickly and easily attached to any motor and are moderate in price.

Complete descriptive catalog on request.

Dealers and Jobbers: let us tell you more about Philbrin ignition. Get an idea of what we can do for you. Write for complete information, catalog, etc.

PHILIPS-BRINTON COMPANY
501 South Broad, Kennett Square, Penna.

PHILBRIN
IGNITION SYSTEMS

4 Cyl. 6 Cyl. 8 Cyl. 12 Cyl.

PHILBRIN

Mr. Dealer,—

You're saving money for your customers and making money for yourself with Michelin products, backed by the new Michelin co-operative plan.

In the first place, Michelin tires are the best and highest quality tires it is possible to build and yet the

Michelin list is low as compared with other quality lists—very low.

MICHELIN

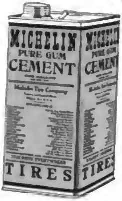
SO you save your customers money by selling them high quality tires, tubes and other Michelin products at really ordinary prices—a big saving.

The new Michelin co-operative plan—which doesn't cost you a penny—makes money for you, not only in the tire end of your business but by reducing selling costs in your general business.

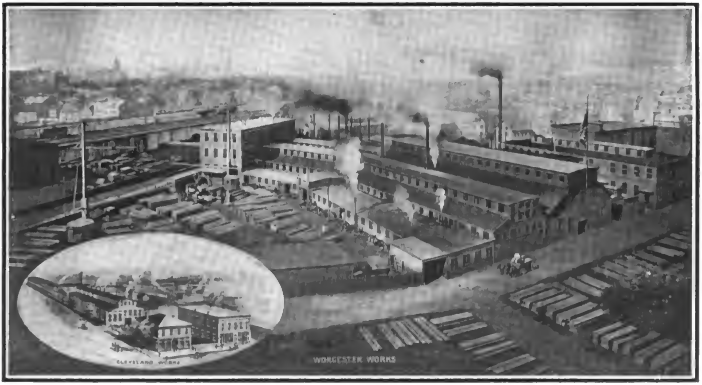
It's a sure fire up-to-the-minute proposition—the most attractive proposition that has ever been presented to tire or accessory dealers in the country. Don't delay getting in touch with it, for delay means loss of profits.

MICHELIN TIRE COMPANY

Milltown - - - - New Jersey



WYMAN-GORDON



Here is the Place to Bring Your Forging Problems!

¶ Not only do we guarantee you design, workmanship, material and delivery, but we promise you a lively interest and complete co-operation in arriving at the most satisfactory fulfilment of your own particular requirements.

¶ This means satisfaction, it means the comfort that comes of certainty, of the knowledge that your engine parts are all that they should be, all that they possibly could be within the bounds of human effort.

¶ And it means true economy of production, for our aim is to produce forgings fully competent to bear the burden thrown upon them at the least possible cost of production.

¶ For instance, it is possible to produce a crankshaft by our special methods, "inherently balanced" in respect of rotational stresses up to a speed of nearly 3000 r.p.m., without counterweights.

¶ You can cut your cost of production very frequently, at the same time improving the actual efficiency of your product, by a knowledge and proper application of the latest scientific developments. We should be pleased to help you do so.

Wyman-Gordon Company - - Worcester, Mass.
Cleveland Detroit

GUARANTEED FORGINGS

Thermoid

RADIATOR HOSE

Automobile Radiator Hose is a necessity, not an accessory.

It has to stand hot water, anti-freezing solutions, oil, etc. It must not collapse.

The two grades we make will enable you to suit any or all of your customers.

Thermoid Radiator Hose is first quality in every particular. It is the kind to sell the owner of a good car.

Testoid Radiator Hose is good and will stand a lot of hard usage. It is made for the man who doesn't like to pay the price of the very best.

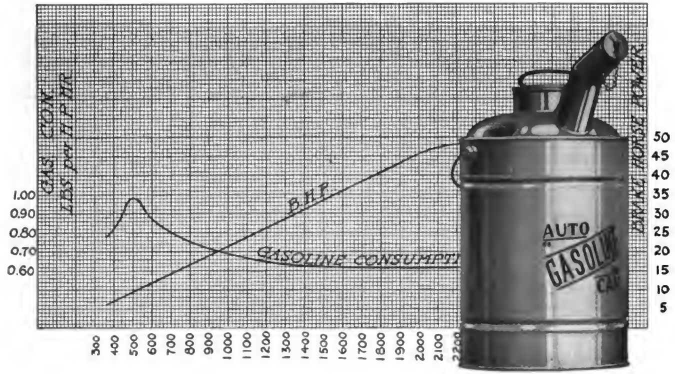
Both grades pass S.A.E. specifications.

The carton which both grades are packed in makes Thermoid and Testoid Radiator Hose easy to handle, display and sell.

Each carton contains six pieces all one size or assorted—three foot lengths; diameters, 1 inch, 1¼ inches, 1½ inches, 1¾ inches, 2 inches and 2¼ inches.

Remember Our Guarantee
Thermoid must make good or we will.

Thermoid Rubber Company
TRENTON, NEW JERSEY



Where Every Drop Does Duty

Power is one thing—power with fuel economy another.

In Ferro V-Type Motors the economy in gas consumption is as notable as the remarkable power-development. Every drop of fuel yields a full measure of energy.

The explanation is found in a combination of features:

Overhead valves, with cages eliminated, permitting unusually efficient cooling of valve seats;

Double-chamber carburetor, furnishing each cylinder bloc its own supply of gas;

Completely water-jacketed intake manifold, with water at outlet temperature, insuring quick vaporizing of gas;

Cylindrical combustion chambers, completely machined, so that there are no rough surfaces or pockets as in other motors. This prevents any appreciable part of the gas from escaping the spark.

Full information about Ferro V-Type Motors on request

THE FERRO MACHINE & FOUNDRY COMPANY
1293 Hubbard Avenue Cleveland, O.

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Reg. U.S. Pat. Off.

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LEARN THE AUTOMOBILE BUSINESS—EARN $75. TO $300. A MONTH

With the New Building and Thousands of Dollars Worth of New Equipment, Our's is the Largest Exclusive Auto School in the Country

Detroit trained men get preference and get jobs quickly. Think what it means to learn in the Michigan State Auto School. Factories endorse our School, glad to employ our graduates or offer them territory. Men are needed everywhere as testers, repair men, chauffeurs, garage men and service men. Hundreds of our graduates start in business for themselves.

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We teach you to handle any auto proposition. Students actually build cars from start to finish, getting factory training in assembling, block-testing, road-testing, everything. Special complete course in Oxy-Acetylene brazing, welding and cutting, separate from regular course. All leading types of starting, lighting and ignition systems in operation. Six-cylinder Lozier, eight-cylinder King used for road instruction. We have a new Chalmers "6-30" chassis with 3400 r. p. m. motor, also a 1917 Detroiter-4 and an Overland. Just added Delco System, used in Buick, Hudson and Packard Twin-6. Have a 1917 Willys-Knight complete chassis.

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There are 44 auto factories in Detroit and 140 accessory and parts factories. We operate Westinghouse, Autolite, Bijur Service Stations. This has added thousands of dollars' worth of equipment and makes our electrical department unequaled. Students get actual experience in handling all kinds of electrical auto equipment. We have just installed a Sprague Electric Dynamometer for block-testing purposes for students' use. The Michigan State Auto School is the only Auto School having this equipment. Auto factories need Dynamometer men constantly. School open all the year. You graduate in from 10 to 12 weeks. Enter classes any time, any day. Three classes daily: morning, afternoon, evening. There is a great demand for Michigan State Auto School students. Auto factories call for men constantly to fill permanent places.

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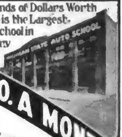
We guarantee to qualify you in a short time for a position as chauffeur, repair man, tester, demonstrator, garage man or automobile dealer, paying from $75 to $300 monthly, or refund your money. We have constantly more requests for Michigan State Auto School Graduates than we can supply.

Follow the Crowd to the Michigan State Auto School. Come to Detroit.



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THE HEART OF THE AUTO INDUSTRY
THE AUTOMOBILE CENTER OF THE WORLD
44 AUTOMOBILE FACTORIES
140 ACCESSORY FACTORIES

DEALERS' OPPORTUNITY

We can supply competent high grade men to handle your garage and repair shop. Our Graduates are especially well fitted to handle electrical troubles. They get actual experience while in their final work. We are constantly supplying men to all parts of the country.

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We have arrangements with the Auto factories to put them in touch with men who intend going into business for themselves. The factories are looking for trained men to represent them. Come here and start right; get the information first-handed and don't wait.

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Act Quickly—Now—Don't Wait!

Get full particulars, "Auto School News" and New Catalog, both absolutely free, or better still, jump on the train, as hundreds have done, and come to Detroit, the "Heart of the Automobile Industry," and learn right.

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A. G. ZELLER, President
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Motorists who **know** searchlights, no matter what car they drive, are very likely to discriminate in favor of the OWL Light—

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(2) because it offers exclusive patented features obtainable in no other searchlight;

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Have You This Plug On Your Car?

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Consists of

Fifty simplified instructions with 1750 illustrations treating every detail of the automobile from the principle and construction to valve timing, etc., with examination questions which bring out just those points you want to know and ought to know—points you would never gain by reading a book.

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All packed in a neat box with full instructions.

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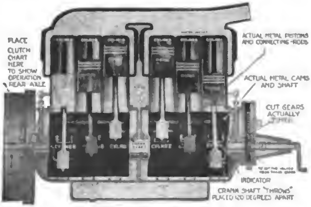
Lord Montagu of Beaulieu, member of the House of Lords and founder of the great Brooklands automobile tracks near London, writes: "I have read your Auto Instructor and consider it to be of great value." Elwood Haynes: "I regard this as just the kind of instructor needed, in order to show not only the mechanism, but to show it in actual operation." Chas. Duryea: "I did not think it possible to get so much real information into such an instruction and yet keep it so concise and simple." Barney Oldfield: "If a person can't learn from this he can't learn at all." Elbert Hubbard (deceased), said: "Your proposition seems to me the most reasonable and direct method of teaching a beginner."

Mr. Dyke has been identified as a pioneer inventor, supply men, etc., with the auto industry since its beginning. He originated the first auto supply company and manufactured and marketed the first float type carburetor and published the first practical automobile book in America.

The Dyke Method of Teaching by Mail is a new idea. A new invention. Working models are used on which you can see the parts in actual operation.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ACTUAL METAL PISTONS AND CONNECTING-RODS
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CRANK SHAFT "THROWS" PLACED 120 DEGREES APART

This is the crank shaft and piston side of the 6-cylinder engine model. This model and 6 others included with course. Price of 6-cyl. engine model alone, $3.35 prepaid. (Models work by hand.)

Write now for descriptive matter or order a set today. The supply of models is limited. (Imported from London.)

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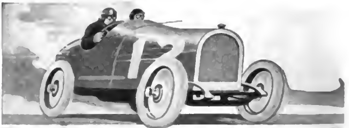

Faster! Faster! Faster!

Speed—power—they call for *perfect ignition*—a spark so flashing, burning hot that the mixture doesn't matter. Richest mixture to leanest, you'll get a full explosion every time if you have an

EISEMANN MAGNETO

Just as good at lower speeds, too. Even when your motor is barely turning over, the Eisemann spark is hot and powerful.

EISEMANN MAGNETOS are so dependable and efficient that 108 manufacturers of Pleasure Cars, Trucks, Tractors, etc., have adopted them as standard equipment. That should mean something to you!

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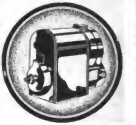

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Branch Factories:
Chelsea, Mass.; Montreal, Canada; England, Germany, France, Austria, Sweden, Italy, Australia.
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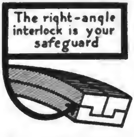
Beware of Imitations



This perfect three-piece construction justifies the name—EVER-TIGHT. Note how accurately the right angles fit together. Engineers and Engine Builders acknowledge that this is the only proper construction for safety and prevention of leakage.

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Keep ALL the Power INSIDE Your Cylinders

The power you lose through leaky cylinders does not help your engine along at all. Yet it costs you money. Install Ever-Tight Piston Rings and save this valuable power.

Ever-Tight Piston Rings are made especially for **leaky cylinders.** They are guaranteed to give compression in out-of-round cylinders as well as in true ones. You do not have to re-bore worn cylinders—Ever-Tight will fit them. They *increase* compression and *decrease* friction, giving from 15% to 25% more power. **Ever-Tight** Piston Rings are the greatest gasoline savers and practically eliminate carbon troubles.

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Motorists everywhere are enthusiastic users of **Ever-Tight** Piston Rings. Why not install them in *your* car?

For sale by all dealers.

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Two leather-covered grips that fit on the steering wheel—one for each hand. Neat; not fussy-looking or clumsy. Warmed by the "juice" from your storage battery—in Ford cars, from the magneto. Takes less than it does to run your headlights.

Easy to attach. Just slap 'em on and hook in the wires. In ten minutes you're rigged up ready for the longest run in the coldest weather.

GUARANTEED for five years against burnout. Guaranteed to do everything we claim for them; money refunded if they fail.

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DRAW TRADE. Steer Warms bring new customers; to buy not only Steer Warms, but other things as well. They make people do more winter driving; thereby increasing the dealer's trade in accessories and supplies.

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For multicylinder Automobile and Truck Motors

This magneto fires any kind of fuel. It operates any number of cylinders up to 12. Without Impulse Starter, known as Model T. Both the T and T-K are entirely enclosed as protection against water, oil and dirt.

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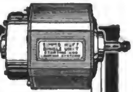

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ELECTRIC STARTING & LIGHTING

"I have an early 1915 Chevrolet car, which depends entirely upon the Simms magneto for its ignition. I am unable to understand how a magneto can be made that operates so faithfully and without adjustment or attention. I start the car by hand and use it every day, even in zero weather. The magneto has never failed me in the 15,000 miles the car has been driven."

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Efficiency

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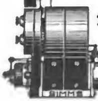

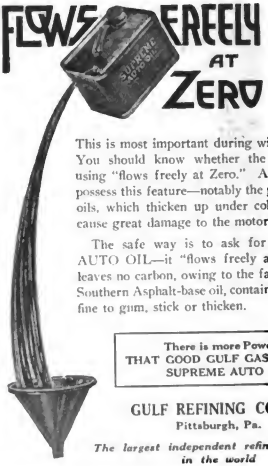

This is most important during winter months. You should know whether the oil you are using "flows freely at Zero." All oils do not possess this feature—notably the paraffine base oils, which thicken up under cold, and often cause great damage to the motor.

The safe way is to ask for SUPREME AUTO OIL—it "flows freely at Zero," and leaves no carbon, owing to the fact that it is a Southern Asphalt-base oil, containing no paraffine to gum, stick or thicken.

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The largest independent refining company in the world

Use the facilities of this perfectly equipped plant for the production of small sheet metal stampings of any design, also

BRASS CASTINGS

in the Rough, Polished or Nickel Plate

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To offset the high price of gasoline, the best engineering talent in the world has perfected light-weight steels and scientific body construction. Aluminum has been largely used despite its scarcity. In almost every part of the machine excess weight has been eliminated.

Strange to say, no one seems to have given much consideration to the weight of tops.

All that is necessary in a good top is found in

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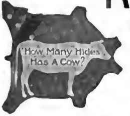
RAYNTITE

Single Texture Top Material

It is guaranteed one year against leakage. No top has a finer appearance, and, although light in weight, it has all the strength required and is built to last as long as the car.

Write for samples and booklet and latest list of cars equipped with Rayntite Tops.


How Many Hides Has A Cow?

Du Pont Fabrikoid Rayntite will duplicate the remarkable success of Du Pont Fabrikoid Motor Quality — the Standardized Automobile Upholstery — used on 60% of 1916's entire output.

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One part of your automobile you do not know you own, because it never bothered you.

ECLIPSE-BENDIX DRIVE

Transmits the power from the starter to the motor on

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MASTER

Calorite Spark Plugs

The highest achievement in spark plug construction. All standard threads carried in stock. Master Calorite Spark Plugs are backed by this broad guarantee: "We guarantee Master Calorite Spark Plugs against defect of material or workmanship and will replace free of charge any Calorite insulators broken by heat which are returned to us transportation prepaid."

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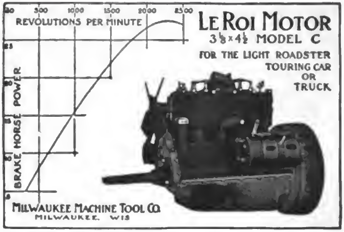

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Passenger and Commercial Car Motors

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Fit Every Demand

There are BEAVER Motors in a variety of sizes, suitable for all pleasure car and commercial car requirements. Meet all demands for power, economy and dependability.

Over-head valves. 20% to 25% more power than other motors of same bore and stroke.

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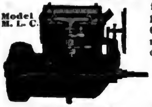
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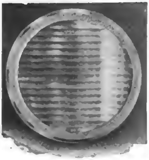

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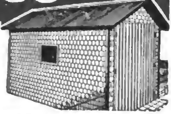

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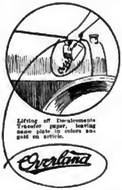

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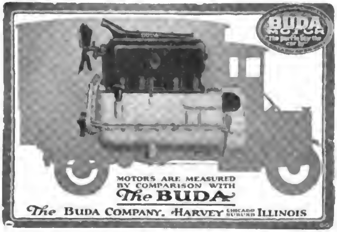

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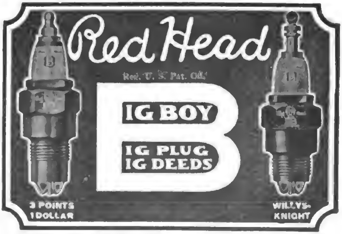

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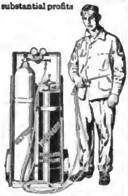

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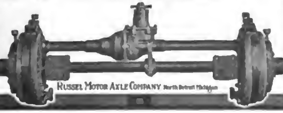

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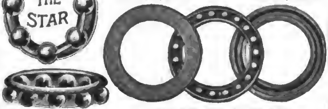

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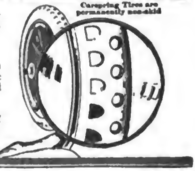
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30x3½	6.95	2.15
31x3½	7.75	2.25
32x3½	8.05	2.40
34x3½	8.95	2.50
30x4	9.35	2.55
31x4	11.50	2.65
32x4	11.60	2.70
33x4	11.90	2.85
34x4	12.10	3.05
35x4	13.25	3.10
34x4½	14.30	3.25
35x4½	14.95	3.40
36x4½	15.35	3.65
37x4½	16.90	3.75
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34 x 3½	8.85	9.75	2.35
31 x 4	8.65	10.60	2.95
33 x 4	9.85	10.85	3.10
34 x 4	9.95	10.95	3.20
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30x3½	8.00	2.25	36x4	14.00	3.50
31x3½	8.50	2.50	34x4½	16.25	4.00
32x3½	9.00	2.50	35x4½	17.00	4.15
34x3½	9.50	2.55	36x4½	17.50	4.25
36x3½	10.75	2.75	37x4½	18.00	4.36
31x4	11.75	2.90	35x5	17.50	5.00
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32x3½	5.25	1.50	35x4½	8.00	1.80
34x3½	5.50	1.60	36x4½	8.25	1.85
31x4	6.25	1.65	37x4½	8.50	1.90
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Black broadcloth outside, lined with finest selected muskrat skins, beautiful large Persian lamb collar, double breasted, 50 and 52 inches long, sizes 36 to 46, ready for delivery. A limited quantity of these handsome garments to close out, price

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Wood and Steel Sectional and Portable Buildings
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ALL SEASON'S RECORDS
made with
SCHEBLER EQUIPMENT

Why not get a Schebler Model R Carbureter for your car? Our exchange proposition makes it easy.

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Direct Factory Distributor
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SLIGHTLY USED CARBURETORS
Stromberg, Rayfield and Model L Schebler in nearly all sizes, $8 each. Condition guaranteed. Terms C. O. D. or cash with order. When cash accompanies order goods are shipped prepaid. **Henry A. Carrier, 5 Harmony St., Salem, Mass.**

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Why bother with gears, brackets, etc., when a Brown Pump can be attached to your motor in an instant and always ready for use.
Outfit is complete with Q.D. Plug, hose, gauge, etc.
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In stock and to order. Send for Catalog.
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Rear Axle Housings - Drop Forgings
Heavy Stampings
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Milwaukee

AUTOMOBILE Body Sheets
Also materials for Tanks, Hoods, Guards, Fenders, Radiators, Frames, Etc. "THURITE" Deep Drawing Stock, Enameling and Japanning Stocks, Roofing Products, Etc.
AMERICAN SHEET AND TIN PLATE COMPANY, Frick Bldg., Pittsburgh, Pa.

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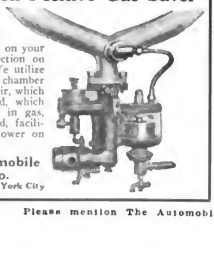

This attachment is absolutely guaranteed to give from 40 to 60 per cent more mileage on your gas. Note the connection on the float chamber. We utilize the vapor in the float chamber and permeate it with air, which heretofore was wasted, which gives a large saving in gas, more power and speed, facilitates starting, runs slower on high. Price $5.00.

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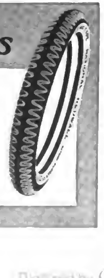

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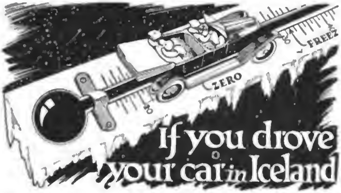
FREEZ
ZERO
If you drove your car in Iceland

You could be certain of perfect lubrication *all the time*—if the gears and bearings were protected by NON-FLUID OIL.

TRADE MARK REGISTERED IN
NON-FLUID OIL
UNITED STATES PATENT OFFICE

Gives Perfect Winter Lubrication

Unlike grease, Non-Fluid Oil does not freeze. It follows the gears the *instant* the car starts and keeps on lubricating *every minute* the car is in motion.

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NON-FLUID OIL lasts longer and kills friction better than any grease. Sold only in orange colored cans at your dealer's.

"K-OO Special" grade is for gears; "K-OOO" grade for bearings

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36" Diameter x 48" Sand Blast Tumbling Barrels

With two single hose sand blast machines, suction elevating set and sand separator; hoppers are shown below floor, but can be placed entirely above floor if desired.

Complete Sand Blast Plants with Bucket or Suction Elevators and Dust Arresters can be furnished. Correspondence giving requirements solicited.

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Recently furnished to Dodge Brothers. Similar to cut, with hoppers above floor

J. W. PAXSON CO.
Foundry Outfitters
PHILA. PENNA.

Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

Aluminum Casting Co. 48
American Bronze Co. 104
American Sheet & Tinplate Co. 115
Americsn Vanadium Co. 78
Atwater Kent Mfg. Works 86

B

Baker R & L Company 77
Bearings Co. of America 109
Beaver Mfg. Co. 104
Bosch Magneto Co. 65
Boston Blacking Co. 100
Boston Scale & Machine Co. 117
Bound-Brook Oilless Bearing Co. 90
Bower Roller Bearing Co. 1
Brsender Rubber & Tire Co. 105
Brown Co. 115
Brown-Lipe Gear Co. 52
Buda Company 105
Butler Mfg. Co. 109

C

Case, T. M. Co., J. I. 4
Cssidy, E. A., Inc. 106
Celfor Tool Company 108
Central Steel Company 118
Chsmpion Ignition Co. 99
Clyde Motor Truck Co. .... 81 to 84
Columbia Graphophone Co. 88
Continental Motors Co. 109
Corcoran-Victor Co. 107
Cullman Wheel Co. 115

D

Doehler Die Casting Co. 117
Du Pont Fsbrikoid Co. 103
Dyke, A. L. 100
Dyneto Electric Company 107

E

Eclipse Machine Co. 103
Edmunds & Jones Corp. 108
Edwards Mfg. Co. 105
Eisemann Magneto Co. 100
Electric Auto Lite Co. 108
Emerson Motors Co. 62-63
Ever-Tight Piston Ring Co. 101

F

Ferro Machine & Foundry Co. 77
Firestone Tire & Rubber Co. 66
Foster Accessories Co., C. H. 98

G

General Electric Co. 75
Gibson-Hollister Mfg. Co. 107
Grsy & Davis, Inc. .... Front Cover
Grossman Mfg. Co., Emil 105
Guarsnty Securities Corp. 102
Gulf Refining Co. 102

H

Hal Motor Car Co. 50-51
Hartford, E. V., Inc. 108
Hartford Machine Screw Co. 104
Hawthorne Mfg. Co. 106
Henley & Co., Norman A. 64
Hess-Bright Mfg. Co. 80
Houk Mfg. Co. 106
Hyatt Roller Bearing Co. 109

I

Indiana Rubber & Ins. Wire Co. 108
Interstate Electric Co. 101

Index to Advertisers

J
Johns-Manville Co., H. W. 87
Johnson & Son, S. C. 89

K
Kissel Motor Car Co. 108
K-W Ignition Co. 102

L
Legalite Corp. 105
Liberty Motor Car Co. 104
Longaker Co., V. A. 67

M
Mercer Automobile Co. 109
Merrill Spring Co., E. R. 115
Meyercord Company 105
Michelin Tire Co. 93-94
Michigan State Auto School 98
Milwaukee Machine Tool Co. 104
Monroe Motor Co. .... 53 to 60 & 61
Moon Motor Car Co. .... 3rd Cover
Motor Age 106
Motor World 104
Mutty Co., L. J. 68

N
National Motor Car & Vehicle Corp. 47
National Rubber Co. 115
New Departure Mfg. Co. 2
New Process Gear Co. 74
Norma Co. of America 3
N. J. Car Spring & Rubber Co. 109
N. Y. & N. J. Lubricant Co. 106

P
Parish & Bingham 105
Paxson Co., J. W. 116
Perlman Rim Corp. 104
Perry Auto Lock Co. 73
Pfau Mfg. Co. 103
Philips-Brinton Co. 92
Pittsfield Spark Coil Co. 109
Prest-O-Lite Co. 106

R
Regal Motor Car Co. 108
Remy Electric Co. .... Back Cover
Reo Motor Car Co. 79
Republic Rubber Co. 76
Rockwood Mfg. Co. 107
Russell Motor Axle Co. 107

S
Salisbury Wheel & Mfg. Co. 106
Sheldon Axle & Spring Co. 106
Simms Magneto Co. 102
Smith Co., A. O. 115
Splitdorf Electric Co. 103
Starrett Co., L. S. 85
Stevenson Automobile Appliance Co. 115
Stewart-Warner Speedometer Corp. .... 2nd Cover
Stromberg Motor Devices Co. 109
Studebaker Corp. .... 69 to 72

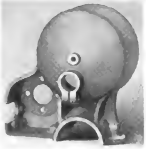
T
Thermoid Rubber Co. 96

U
United Alloy Steel Corp. 91

W
Waltham Watch Co. 49
Ward Leonard Electric Co. 107
Waukesha Motor Co. 105
Weston Electric Instrument Co. 107
Winkley Co. 108
Wisconsin Motor Mfg. Co. 107
Wyman & Gordon Co. 95

Z
Zapon Leather Cloth Co. 99
Zenith Carburetor Co. 106

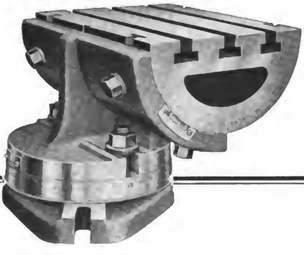
DOEHLER
DIE-CASTINGS



are the standard of comparison in the ever-growing die-casting field. Their consistent use by the representative manufacturers of Automobiles and Automobile Accessories attest to the merits of the DOEHLER product.

The DOEHLER die-cast control housing here illustrated will be easily recognized as used on one of the best known of the highest grade cars made.

DOEHLER DIE-CASTING CO.
BROOKLYN. N.Y.
NEWARK. N. J. TOLEDO. OHIO.



Universal Angle Plate

Displace your inaccurate and makeshift rigs with the UNIVERSAL ANGLE PLATE. This beautiful and efficient tool is particularly adapted to jig and fixture work, and will be found indispensable in the tool room. Has a motion through 360° horizontally, and 90° vertically. Can be adjusted quickly to any angle without disturbing work bolted on plate. Accurate graduations with vernier attachment permit of especially careful work. Rigid and Well Built.

Dimensions and Prices
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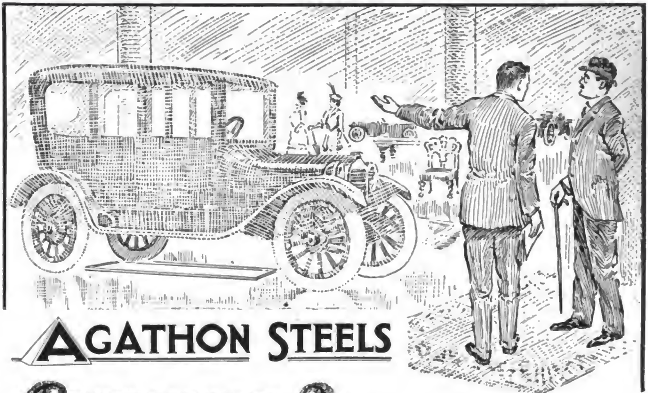
6 x 8 .... 75.00
8 x 10 .... 100.00

Has unlimited possibilities of application for exceptional work on Lathes, Planers, Milling Machines, Shapers, Drill Presses and Grinders.

Boston Scale and Machine Company
381-389 Congress Street Boston, Mass., U. S. A.



AGATHON STEELS

THE DEALER—And AGATHON STEELS

When you can say to your dealer, "The best of everything is used in manufacturing our cars, from the raw steel to the finished automobile," he has talking points of incalculable value.

Tell him Agathon steel is used in its manufacture. Explain how this steel is peculiarly fitted for use in automobiles because of its great strength and resistance to shocks. He in turn will impress the customer, the ultimate purchaser, with what the use of such steel means. The customer will appreciate the merits of such a car and the result is a sale.

Agathon steel is the ideal one for motor car construction.

AGATHON STEELS
TRADE MARK

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"Agathon" Chrome Steels
"Agathon" Vanadium
"Agathon" Chrome Vanadium
"Agathon" High Carbon
"Agathon" Nickel Steels
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ST. LOUIS. MO. U.S.A.

The Season's Smart Cars

Whatever the price may be, a car so *convincingly* attractive as the new 1917 Moon hasn't yet "come along".

Here is beauty of the kind that is deeper than mere nickel or brass and fresh enamel. The Moon—with its sweeping, unbroken lines; long, double-cowled Delaunay-Belleville body and rakish slant of windshield—is obviously the season's smart car.

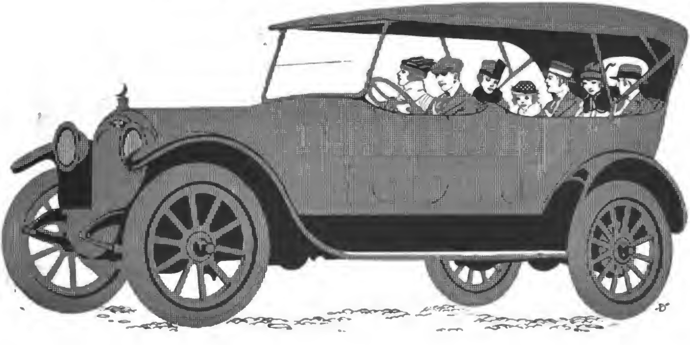
Within, the new Moon is *Moon* straight through—powerful—staunch—on the *qui vive* to do your bidding—generous of elbow and leg room — upholstered (both models) in genuine tan Spanish leather.

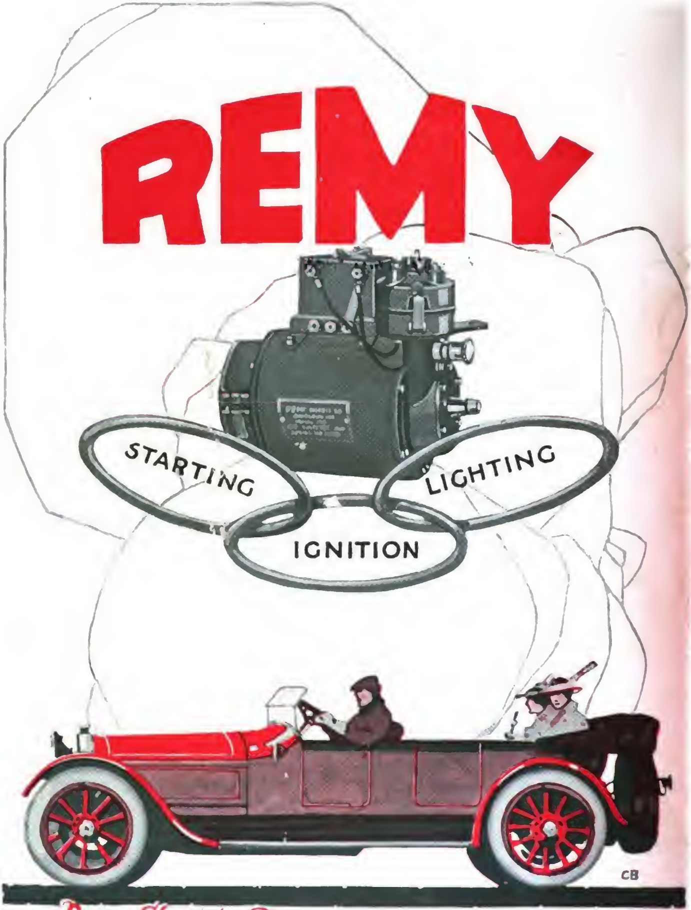
Six-66
(66 Horsepower Actual Brake Test)
Seven passenger fully equipped $1650

Six-43
(43 Horsepower Actual Brake Test)
Five passenger fully equipped $1295

Write for literature, illustrating and describing these and other models

MOON MOTOR CAR COMPANY ST. LOUIS, U. S. A.





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The AUTOMOBILE

Vol. XXXV
No. 24

NEW YORK, DECEMBER 14, 1916

Ten cents a copy
Three dollars a year

FASTER! Open the throttle—advance the spark—tramp on her tail—one minute to make it. Easy enough with a Continental, when you want to get there, and get there quick.

Yet the flash of swiftness, or the mad onrush that crashes through the smoke welter of the speedway, is really not the speed that counts; for it is a fever, not an excess of vitality. Continental speed is that healthy speed which endures; which, day in and day out during long years of service, can be depended upon for every emergency. More speed than you will ever need—that is the measure of Continental ability.

For speed is the daughter of power. And power is characteristic of the Continental Motor—power abundant yet within bounds, bringing no risk, never creeping to the danger mark. Continental speed and power are attained by efficient design carried out under exacting standards of workmanship.

These surpassing qualities have been made possible by the sterling work of the foremost technical experts of both America and foreign lands, men of the Continental and allied firms. Their work has made the Continental America's standard motor.

*Booths 50 and 51, Chicago Automobile Show,
Coliseum Gallery.*

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Largest exclusive motor manufacturers in the world.

Editorial Contents, Page 3

Advertisers' Index—Next to last page

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Stewart Speedometer

$25

$1

Stewart X-Ray Spark Plug

No Profitless Days with Stewart Products

Dealers sell Stewart Products every day, every week, every month in the year.

Each season is a Stewart Products season. That is one reason why Stewart Products are such a fast-selling and profitable line for dealers.

Stewart Products have a big sale in Winter, Spring, Summer and Fall—they are needed and used all the year 'round.

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The same is true of all Stewart Products—each one is a Winter necessity.

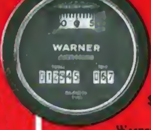
"It will pay you to see that every car is equipped Stewart."

STEWART-WARNER SPEEDOMETER CORPORATION
CHICAGO, U. S. A.

Stewart
PRODUCTS

$6

Stewart
Motor Driven
Warning Signals



$50

Warner
Auto-Meter

Stewart
Vacuum System

$10

$3.50

Stewart
Hand Operated
Warning Signal

$12

Stewart
Tire Pump

$10

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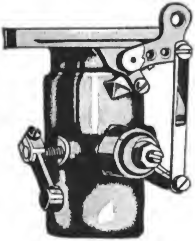
for Fords

Introducing a new and distinctly different carbureter

—a small, extremely compact little instrument which, by virtue of its very compactness, performs the delicate measuring or apportioning functions of carburetion with unerring accuracy—at all motor speeds.

TOM THUMB has "hair trigger" action. On acceleration it is a case of touch and go. When it comes to speed, every ounce of power is developed of which a motor is capable. Instantaneous responsiveness of this kind to the slightest throttle changes is a TOM THUMB characteristic.



The ANY FUEL Carbureter—Will Handle Gasoline, Part Kerosene and Part Gasoline or All Kerosene.

Tom Thumb, Jr. for FORDS $15.00

N-E-C-O Tom Thumb CARBURETER

Remarkable results obtained in all lines of service with TOM THUMB may be largely attributed to **simplicity of construction.** All lost motion, all complication has been designed away. **TOM THUMB has fewer parts than any carbureter made.**

TOM THUMB is a 1916 carbureter modernly designed to cope with 1916 fuel conditions. It handles present-day low-proof fuel perfectly. Old model cars equipped with obsolete carbureters show instantaneous improvement immediately upon the installation of a TOM THUMB.

FORD OWNERS cannot appreciate what driving a lively car means till they have equipped with TOM THUMB, Jr., for Fords.

TOM THUMB is guaranteed to give better results than the carbureter you are now using—or your money refunded.

Sold on 30 days' money-back trial—Ask your dealer, or write for full information.

Motorists and Dealers interested in kerosene as a fuel send for particulars describing the NECO Dual Fuel System.

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THE NATIONAL EQUIPMENT CO.
135 South Racine Avenue Chicago, Illinois

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JOHNNY AITKEN

ED. RICKENBACHER

DARIO RESTA, 1916 RACING CHAMPION

AITKEN, Second, and RICKENBACHER, Third—ALL USE THE WORLD'S FINEST MOTOR OIL,

Oilzum

The **Motor Oil** that Resists the Heat, Remains and Lubricates Longer and Better, Increases Power, Induces Smooth, Quiet Running, Reduces Oil Consumption, Prevents Smoke and Minimizes Carbon Troubles.

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FIRST:	In Grand Prix, Nov. 18,	403 Miles	85.59 m. p. h.	Aitken	Peugeot	Oilzum
FIRST:	In Ascot Derby, Nov. 30,	150 Miles	67.54 m. p. h.	Rickenbacher	Duesenberg	Oilzum

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Cornell, Limited, Adelaide, South Australia.
Empire Oil Co., Wellington, New Zealand.

The Automobile
THE CLASS JOURNAL COMPANY
231—241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

VOL. XXXV NEW YORK, DECEMBER 14, 1916 NO. 24

Important Trade News of the Week.......991-1001

Editorials 1002

Germany After the War......................1003

Westinghouse Noiseless Bakelite Gears........1005

Four Is Ultimate Engine.....................1006

Warming Manifold for Using Heavy Fuel......1007

Pressure Lubrication Advantages............1008

Herschell-Spillman Manufactures Water Brake.1011

Standardization in Detroit Electric 1012

Amesbuilt All-Season Cloverleaf for Fords.....1014

Murray Eight Has Custom Style..............1015

The Engineers' Forum........................1016

Melting Scrap Aluminum.....................1016

Self-Oiling Bushing's Many Uses..............1017

Baker Steel Wheel Has Tension Spokes........1018

Low Fuel Is Carbureter Problem..............1019

A German Aeroplane Propeller Hub...........1021

Few Changes in Carbureter Design...........1022

Industrial Miscellany.........................1031

Automobile Calendar..........................1031

INDEX TO ADVERTISERS...100-101

WYMAN-GORDON

Come to us with your forging problems.

We have been solving such problems for years. That we have solved them correctly is indicated by the enthusiastic loyalty of our customers, as well as by the remarkable efficiency of our output.

The Wyman-Gordon "inherently balanced crankshaft" has accomplished much. We shall be glad to discuss with you the principle on which its design is based.

Leading automobile manufacturers will testify to the work we have already done.

GUARANTEED FORGINGS

WYMAN-GORDON CO.
WORCESTER, MASS.
CLEVELAND DETROIT

Studebaker

Established 1852

Tremendous Demand for New Series 18 Studebaker

Dealers in every section of the United States are reporting actual sales of many hundreds of the new Series 18 Studebaker cars. They tell us that never in the history of the industry has an announcement of new models created such enthusiasm and buying activity. They've had crowded showrooms all week long—and small wonder!

You read our four-page insert in this magazine last week, of course, and you cannot help but realize the reception the buying public was sure to give the new Series 18 Studebakers. With no radical changes in the basic Studebaker design, but with many new and exclusive additional features, the Series 18 cars embody all the essentials that the motor car buying public expects to find in cars costing from $2,000 to $3,000. They give the dealer something to talk about—added refinements and improvements that offer an irresistible appeal. The Studebaker owner now receives every desirable feature the industry knows—at prices that are from 50% to 100% less than other cars of corresponding value.

Read last week's Studebaker announcement over again. Note what we say about the Series 18 Studebaker's fine gun-metal finish, deep genuine leather upholstery, individual and adjustable front seats, the new reversible seat next to driver's, comfortable arm chair auxiliary seats, Yale Ignition Lock, Blackmore Door Curtain Opener, etc. These are only a few of the many factors that give the Studebaker dealer a great advantage over the majority of competition.

If you are interested in a kind of dealer representation that brings prestige with profit, unlimited selling opportunities and a chance to "cash in" on the tremendous demand for the great and dominant Studebaker line of motor cars, address your request for further details to

STUDEBAKER

South Bend, Ind. **Detroit, Mich.** **Walkerville, Ont.**

Address All Correspondence to Detroit

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, DECEMBER 14, 1916—CHICAGO NO. 24

Ajax to Purchase Racine Co.

Will Ratify Deal on Dec. 26—Ajax Increases Capital to $10,000,000

NEW YORK, Dec. 12—The Ajax Rubber Co., Inc., of this city and with a factory in Trenton, N. J., has arranged for the purchase of the Racine Rubber Co., Racine, Wis., and has called a meeting of its stockholders for Tuesday, Dec. 26, at which the purchase of the Racine Co. will be ratified. It is understood that this purchase will not change the present status of the Racine Co., which manufactures Racine and Horseshoe brand tires. The purchase of the Racine company is in exchange for shares of the captital stock of the Ajax organization.

New Capitalization

As a part of this purchase the Ajax company has increased its capital stock from $5,000,000 to $10,000,000. Up to the present there has been 100,000 shares of capital stock with a par value of $50, but under the new arrangement there will be 200,000 shares at the same par value. The entire stock is common and there are no bonds. As a result of the deal and the rumors of it Ajax stock rose on the New York Stock Exchange from $70 to $90 in the past 10 days. The company has been paying 10 per cent dividends.

Rapid Development

During the past year Ajax has developed very rapidly, increasing its daily output from 2000 casings to 5000. There has been a similar increase in the manufacture of tubes. During the year a new factory building, 550 by 350 ft. and three stories in height, has been occupied. In addition other warehouses have been built. During the year the number of dealers handling Ajax tires has been increased from 4000 to 6000. In addition seven new branch houses have been opened, bringing the total to 23.

The Racine Rubber Co. has sold its output to approximately fifty to sixty jobbing accounts in contrast with the Ajax distribution through 6000 dealers. In this respect the lines complement each other and the present policy of distributing the Racine product through jobbers will be continued. The volume of business of the two concerns is approximately the same.

Cadillac Prices $160 Higher

DETROIT, Dec. 11—The Cadillac Motor Car Co. will raise prices on all models $160, effective midnight Dec. 14. All cars shipped after that time will be charged at the new prices with the following exceptions subject to prior sale. It will furnish at present prices cars of each body style to customers' signed unfilled contracts in the possession of the dealers on Dec. 14.

Increase Mack Truck Prices

NEW YORK, Dec. 8—The International Motor Co., this city, will advance its list prices on the Mack truck Jan. 1, as follows: 1-ton, $2,000 to $2,150; 1½-ton, $2,350 to $2,500; 2-ton, $2,700 to $2,800; 3½-ton, $3,400 to $3,650; 5½-ton, $4,000 to $4,250, and 7½-ton, $4,500 to $4,600.

Austin Increases Prices

GRAND RAPIDS, MICH., Dec. 11—The Austin Automobile Co., has increased the prices on its different 1917 models as follows: The two and four-passenger roadster from $3,150 to $3,750; the five-and six-passenger touring car from $3,400 to $3,750, and the seven-passenger touring car from $3,400 to $3,750; the coupé from $3,950 to $4,550; the sedan from $4,350 to $4,950, and the limousine from $4,650 to $5,250.

Analyzes After-War Conditions

Report of Federal Trade Commission Manifests Confidence for Future

WASHINGTON, Dec. 12—What will trade conditions be after the war is one subject handled in the long-looked-for recommendations from the Federal Trade Commission which deal with problems that will confront the United States, especially exporters, when hostility ceases. This report is a comprehensive review covering years of foreign trade conditions.

With regard to meeting European trade, the three important considerations involved are:

First—The presence of concerted action among the foreign competitors of American exporters.

Second—The probable effect of similar action by American manufacturers in foreign trade, including its possible disadvantages to domestic consumers and smaller competitors.

Third—The effect of the present laws of this country upon such co-operation on the part of American manufacturers.

Co-operation Advantageous

"The commission believes," says the report, "that the advantages to be gained by effective co-operation in foreign markets need not entail any sacrifice of the firmly established policy of this country in regard to the maintenance of fair competitive conditions and the prohibition of monopolistic control within the United States. At the same time, co-operation for export trade will enable the exporting manufacturer to realize an increased return for his products along with decreased costs through larger scale production, and the country

(*Continued on page* 1000)

Newby Resigns from National

Had Directed Company's Affairs for 16 Years—Dickson Succeeds Him

INDIANAPOLIS, Dec. 10—Arthur C. Newby, founder and for 16 years president of the National Motor Car and Vehicle Corp., has relinquished the presidency of the company to his chief assistant and general manager, G. M. Dickson. Mr. Newby has not been in the best of health lately and his retirement has been expected. He continues, however, to be the largest individual National stockholder.

A pioneer in the automobile field, having been with the National Electric Car Co., back in 1888, and 2 years later forming the National Gasoline Engine company, he has naturally been an enthusiast in the industry's activities. He was a leader in the early days of racing, being a staunch advocate of stock car racing. His cars were usually among the leaders, if not winning.

Recent connection made with the substantial new interests in the affairs of the National company, were the means of greatly increasing the size and production of the factory. With the company on the enlarged basis Mr. Newby proposed that Mr. Dickson be made president.

Mr. Dickson is not a newcomer to the automobile field, being associated with Mr. Newby at the National plant for 15 years.

With the change of titles the new officers are the same individuals who have assisted in the management of the factory for the past 10 years. They are: G. M. Dickson, president and general manager; W. Guy Wall, vice-president and chief engineer; and M. E. Elstum, secretary and treasurer.

Precision Die Casting Merges Two Companies

SYRACUSE, N. Y., Dec. 9—The entire business of the Van Wagner Die Casting Corp., formerly the E. B. Van Wagner Mfg. Co., and the Precision Die Casting Co. has been purchased from Charles Van Wagner and the two companies will be merged into the Precision Die Casting Co., with a capital of $315,000.

Alterations and extensions to the factories have already been undertaken and more capital provided to take care of increased business.

The officers and directors of the new company include: President, T. G. Meachem, vice-president and general manager of the New Process Gear Corp.; vice-president, J. W. Knapp, treasurer of the Van Wagner Die Casting Corp.; treasurer, H. S. Tenney, secretary of the Syracuse Trust Co., and secretary, E. J. Quintal, of the accounting firm of Farrell, Sehl & Quintal. The above officers and the following include the directors: A. P. Bellinger, of the Solvay Process Co.; G. W. Bowen, of the G. W. Bowen Mfg. Co., Auburn, N. Y., and W. A. Ball, of the Semet Solvay Co.

Gauvreau Joins Buick

DETROIT, Dec. 9—Victor Gauvreau has resigned as chief engineer of the Frontenac Motor Co. to join the Buick Motor Co., Flint, Mich.

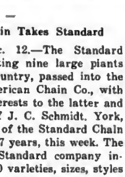
Weed Chain Maker Plans Capital Increase of $6,000,000

NEW YORK, Dec. 13—Stockholders of the American Chain Co., maker of the Weed chains, have been notified that a meeting will be held on Dec. 22 for the purpose of voting on an increase of capital from $4,000,000 to $10,000,000 by increasing the preferred from 20,000 shares, par $100, to 50,000 shares, par $100, and by increasing the common from 20,000 shares, par $100, to 50,000 shares, par $100. Each share of additional preferred will be entitled to the same preference and priority over the common as the preferred now issued and outstanding.

American Chain Takes Standard

YORK, Pa., Dec. 12.—The Standard Chain Co., operating nine large plants throughout the country, passed into the hands of the American Chain Co., with the sale of its interests to the latter and the resignation of J. C. Schmidt, York, Pa., the president of the Standard Chain Co. for the past 17 years, this week. The products of the Standard company include at least 1500 varieties, sizes, styles and types of chain, with automobile chain and automobile forgings.

Besides the two plants in York the company had been operating chain plants at Braddock, Allegheny county; rolling mill and Hayden chain plant at Columbus, O.; and one plant in each of the following cities: Carlisle, Pa., Mansfield and St. Mary's, Ohio, and Marion, Ind. The company employs approximately 1700 hands, of these 1000 being employed in the two York plants.



Arthur C. Newby, founder and president of the National company for the last 16 years

Bans Newspaper Publicity

P. O. Points Out It Violates Rule Against Advertising as News Matter

WASHINGTON, D. C., Dec. 12—Automobile publicity which has been carried in daily papers has come under the finger of the third assistant postmaster general, who has notified several daily papers that this publicity is in violation of the act of Aug. 24, 1912, which forbids the running of statements which are properly advertising matter and not news. Large daily papers in many cities have received letters from the third assistant postmaster general drawing attention specifically to items published which are properly advertising information. The department expects to report later on the result of its investigations. The article in question appearing in the daily papers cover a variety of subjects, some refer to the opening of new agencies, others to the photographs of new cars, others to comments on winning contests and others on various subjects. The presumption is that many daily papers have been accepting reading notices from concerns placing advertising, it being stated that the reading notice is a verbal part of the advertising agreement. This situation has come to the attention of the third assistant postmaster general with the results as stated.

There are various suggestions as to how the matter reached official circles in Washington. It has been stated that paper manufacturers displeased with the complaints of publishers have intimated that if the daily press cut out the free readers there would be room for plenty of news that is at present kept out. Those large daily papers which have strongly and consistently opposed this method of publicity are naturally gratified at the present investigation.

In a Friendly Spirit

Third Assistant Postmaster General, W. M. Dockery, discussing with a representative of THE AUTOMOBILE the movement, said he was taking this step in the friendliest possible spirit as toward the newspapers of the country, and he felt and believed it would be only necessary for him to call the attention of publishers to the law which forbids such a practice, to bring about a cessation of this form of activity.

"While it is hard to draw the line of demarcation between a newspaper article discussing certain facts in connection with the performance of a suggested make of an automobile, which article might not constitute an advertisement,

(*Continued on page* 1001)

To Facilitate Argentine Shipments

Mercantile Corp. Formed for Co-operative Trade in Non-Competing Lines

NEW YORK, Dec. 13—The Argentine Mercantile Corp., an organization for the purpose of co-operative trade in non-competing lines, has been started in this city for the purpose of making trade with Argentina easier to handle. Fifty to sixty different U. S. A. manufacturers in varied lines, none connected with the automobile industry, are reported to have met last week for preliminary organization work and will meet later this week to complete organization plans and elect officers.

The plan of this corporation consists in maintaining in the city of Buenos Aires a permanent exhibition of samples of all goods manufactured by those who are members of the corporation. This exhibit of samples will be in charge of salesmen and in addition there will be a force of salesmen traveling through the Argentine Republic in the interest of those belonging to the corporation.

To facilitate shipping of goods, exchange, collections, etc., the Argentine Mercantile Corp. contemplates maintaining a shipping department at the Bush Terminal, New York City, where 3700 sq. ft. of shipping space will be maintained and a clerical shipping force engaged. It will only be necessary for members to consign their merchandise to this office, after which all matters of crating, engaging accommodation, marine insurance, etc., will be handled by the corporation.

In the matter of payments, it is expected that members will be paid for their merchandise when delivered at the Bush Terminal and that the corporation will handle the entire work of collections in South America, banking accommodations, exchange, etc.

According to the present plans, which are very incomplete, each member of the corporation will place samples in the Buenos Aires exhibit, and that the rent for such exhibit building, overhead, and other charges will be paid for by the members according to the exhibit space they occupy. It is planned to place one salesman over each particular line of merchandise, such as agricultural machinery, or automobile accessories, or hardware lines, etc. Only one make of automobile or one make of motor truck would be handled.

The organization of the Argentine Mercantile Corp. has not progressed sufficiently to state what membership initiation fees, and annual dues will be charged. The corporation has been organized for the purpose of profit and dividends will be declared in some manner to those participating. It is expected that manufacturers will sell goods to the corporation at their export prices. It is planned to place the organization in the control of thirty-one directors, fifteen of whom have already been named.

The organization is being fostered by one William Hill Hunt. Mr. Hunt says he has spent some time during the past year in Argentina collecting information on those lines of goods which have sold best in the republic.

Joy Leaves Packard — Dividend Increase

DETROIT, Dec. 14—H. B. Joy has resigned as chairman of the board of directors of the Packard Motor Car Co. because of other interests. At its meeting here yesterday the board of directors increased the dividend on the stock from 7 to 8 per cent yearly payable as 2 per cent quarterly. The next payment is January.

Pfeffer and Brinegar Go to Cuba

DETROIT, Dec. 12—C. A. Pfeffer, who recently resigned as vice-president and assistant general manager of the Chalmers Motor Corp., and E. P. Brinegar, the man credited largely for the organization of the old E. R. Thomas Detroit Co., sailed from New York City last Saturday for a pleasure trip through Cuba.

Holmes Building Own Car

SYRACUSE, N. Y., Dec. 12—Arthur Holmes, formerly sales manager of the H. H. Franklin Mfg. Co., this city, has started a company of his own in this city for the purpose of manufacturing automobiles.

Chalmers to Retire from D. A. C. Presidency

DETROIT, Dec. 8—Hugh Chalmers has announced that he will retire permanently from the presidency of the Detroit Athletic Club, of which he has been the head for the past four terms. Coupled with his announcement Mr. Chalmers has presented the club with Herman Richir's painting "The Red Shawl," which he acquired following its exhibition in the Belgian section of the Panama-Pacific Exposition.

Mr. Chalmers has been the only president the club has had since moving to its downtown location.

Ball & Ball Carbureter on Winton

CLEVELAND, OHIO, Dec. 6—The Winton Co. has adopted the Ball & Ball carbureter, made by the Penberthy Injector Co., as standard equipment.

To Raise Tire Prices 15 to 20%

Increase in Price of Materials and Cost of Manufacture Responsible

NEW YORK, Dec. 9—Leading tire manufacturers are planning to make a substantial advance in automobile tire prices next year. This increase, it is expected, will be between 15 and 20 per cent. Early this year prices were advanced an average of 12½ per cent.

The high cost of the materials used in the manufacture of tires has necessitated this increase. Fabric is now selling at an advance of about 125 per cent over the figure of a year ago. Although crude rubber is not now commanding exorbitant prices, other materials used in tire making are advancing skyward and there is a greater amount of fabric than of rubber in an automobile tire. On an average, the cost of the materials used in tires has risen at least 20 per cent.

Lansdale Leaves Denby Truck

DETROIT, Dec. 11 —Henry Lansdale has resigned the vice-presidency of the Denby Motor Truck Co. Mr. Lansdale has been the vice-president and general manager for the company since 1915.

Girl Heads Standard Parts

CLEVELAND, Dec. 8—Christian Girl is president of the Standard Motor Parts Co., the combination of the Standard Welding Co. and the Perfection Spring Co. The Perfection plant will now be known as the spring department and the Stanweld plant as the rim and tube department.

Other officers of the new concern are: F. W. Prentiss, first vice-president; E. W. Farr, second vice-president; T. E. Borton, treasurer. C. C. Bolton and Arnold S. Goss, together with the officers above, will constitute the board of directors. P. A. Connolly is secretary, but not a director.

Jackson Goes to Europe

DETROIT, Dec. 11 —R. B. Jackson, factory manager for the Olds Motor Works, has gone to Europe to study automobile construction. He will visit London, Paris, Germany and Italy, and will attend the automobile show at Paris besides visiting all factories.

Bethlehem Truck Ready in February

NEW YORK, Dec. 12—Two truck models of 1¼ and 2 tons' capacity will be marketed about February by the Bethlehem Motors Corp., Allentown, Pa. A new plant to have a floorspace of 199,000 sq. ft. is being built. The concern has a capital of $6,000,000, made up of $1,000,000 preferred, paid in, and $5,000,000 common. The preferred is all held by the four men who head the concern.

Arthur T. Murray, formerly of the Brady-Murray Motors Corp., local Chandler dealer, heads the concern as president. Associated, besides Allentown and Bethlehem capitalists, with Mr. Murray is W. S. Stevenson, formerly sales manager of the old Mack Bros. Motor Truck Co., who will be sales manager. D. G. Dery, a silk manufacturer, is vice-president.

Carburetion Subject of Ind. S. A. E. Meeting

INDIANAPOLIS, IND., Dec. 9—The December meeting of the Indiana Section of the Society of Automobile Engineers will be held Dec. 15 in the Assembly Hall of the Claypool Hotel.

The subject of the meeting will be "Carburetion and Manifolding," papers being read by F. C. Mock, chief engineer of the Stromberg Motor Devices Co., and by Professor Berry, professor of experimental engineering, Purdue University.

582 S. A. E. Banquet Tickets Sold

NEW YORK, Dec. 7—Tickets for the annual banquet of the Society of Automobile Engineers on Jan. 11 at the Hotel Biltmore are being sold fast. To date 582 have been sold out of a total of 750. Every seat, numbering 762, has been taken for the special performance of Ziegfeld's Midnight Follies, which comes as a climax to the dinner.

S. A. E. to Meet in Detroit

DETROIT, Dec. 11—The Engine and Transmission Division of the Society of Automobile Engineers, and of the Council of the S. A. E. will meet in Detroit on Dec. 14.

Stetson Motor Car Co. Formed

DOVER, DEL., Dec. 7—The Stetson Motor Car Co., with a capital of $1,000,000, has been incorporated to manufacture automobiles and appliances. The incorporators are P. A. Zizelman, W. Hanford and C. W. Van Ranst, all of New York.

Troy Trailer Sales Co. Formed

TROY, OHIO, Dec. 11—The Troy Trailer Sales Co. has been incorporated under the laws of Ohio by C. A. Geiger, C. N. Peters, G. R. Harris, R. C. Sykes and H. H. Tamplin. The Troy Wagon Works Co. will henceforth market its trailers under the name of the Troy Trailer Sales Co.

New Engine-Testing Method

Prof. Roesch, of Armour Institute, Describes His System Before Mid-West S.A.E.

CHICAGO, Dec. 9—A method of testing automobile engines and of charting the results of these tests in such a manner that a great deal more information becomes available than has been possible in present methods of testing has been developed by Prof. Daniel Roesch, associate professor of gas engineering Armour Institute of Technology. It is Prof. Roesch's contention that the present method shows the performance only under wide-open throttle conditions, a condition not often maintained in use, and that one engine showing superior merits to another under the usual test conditions might not be so good when tested under properly open-throttle conditions, at which most automobile engines are usually operated. His method involves, of course, tests made in the conventional way at various speeds with wide-open throttle and corresponding one at other throttle positions, thus giving power, gasoline consumption, heat losses, effect of spark advance, etc., under all conditions as driving. Prof. Roesch explained his method of conducting tests and outlined the results obtained and what was to be deduced from them in his paper presented at the quarterly meeting of the Mid-West section last night. This meeting was held at the Armour Institute of Technology, Chicago, and after the presentation of the paper and its discussion the speaker conducted the seventy-five engineers and motorists present to the testing laboratory of the institution and actually ran a partial test, according to his new method, on a twelve-cylinder Packard engine.

In the discussion G. A. Smith, of the Nash Motors Co., brought out the fact that the results of Roesch's tests showed the great advantage from economy standpoint of operating the engine at a certain definite speed and that it was one of the reasons for the better economy of European engines that more gear changing was done.

In reply to his question whether all the curves shown were the result of tests and whether all were made on the same carbureter setting, Mr. Roesch explained that the carbureter setting must be maintained constant.

Engineer Mock, of the Stromberg company, suggested that Roesch's method of testing could be used to co-ordinate curves of engine and car performance by using the deceleration test for car performance, and that he had witnessed car tests on the road which showed the practical value of Roesch's charts. He pointed out that chart No. 7 showed the economy of gearing the car low. He said he had witnessed an increase in economy of from 18 miles per gallon to 30 m.p.g. by gearing the car as a truck is geared and shifting as necessary. He felt the spark advance should be susceptible to control according to the throttle opening.

Buffalo Section S. A. E. Formed

BUFFALO, Dec. 13—*Special to* THE AUTOMOBILE—The Buffalo section of the Society of Automobile Engineers was enthusiastically formed here to-night at the Buffalo Engineering Society meeting, 150 being in attendance. The governing committee of the new section is: Chairman, David Fergusson, chief engineer pleasure car department Pierce-Arrow Motor Car Corp.; vice-chairman, C. M. Manly, vice-president and chief engineer Manly Drive Co.; secretary, D. W. Sowers, president and engineer Sowers Mfg. Co.; treasurer, John Younger, chief engineer motor truck department Pierce-Arrow Motor Car Corp. and chairman of membership committee, H. T. Parrock, manager Lumen Bearing Co.

Russell Huff, president of the S. A. E., Coker Clarkson, secretary and general manager, and A. Ludlow Clayden, chairman of the standards committee, spoke on the general advantages of the society, President Huff stating that within 4 weeks the society will have a membership of 2600, the Detroit section now having over 650.

The paper by A. P. Brush on the four-cylinder engine, appearing on pages 1006 and 1007 of this issue, provoked considerable discussion, seeming to fall in with the views of those present.

Re-organization of Ross

DETROIT, Dec. 12—It is reported that C. G. McCutcheon will resign his presidency of the Ross Automobile Co. to take effect Jan. 1, and that a number of New York capitalists will re-finance the concern to the extent of $500,000.

Muir Heads Maxwell Advertising

DETROIT, Dec. 12—Gordon Muir has been appointed advertising manager of the Maxwell Motor Co., Inc. Mr. Muir has been with the Maxwell company for the past year.

Weed Hal Advertising Manager

DETROIT, Dec. 11—J. C. Weed has been appointed advertising manager of the Hal Motor Car Co. of Cleveland.

Lloyd Is Cassidy Advertising Manager

NEW YORK, Dec. 11—L. M. Lloyd has become advertising manager for the Edward A. Cassidy Co., this city. The Cassidy company handles the national sales of many automobile accessories.

Makers Arrange Banquet Program

White Toastmaster—Speakers Include Leland, Coffin and Clarkson

DETROIT, Dec. 12—A reception committee has arranged a program for the Manufacturers' Banquet to be given by the Society of Automobile Engineers on Dec. 14. The committee is composed of D. McCall White, chairman, and chief engineer of the Cadillac Motor Car Co.; B. G. Koether, general sales manager of the Hyatt Roller Bearing Co.; Russell Huff, chief engineer for Dodge Bros.; W. C. Rands, president of the Motor Products Corp.; K. W. Zimmerschied, chief metallurgist for the General Motors Co.; R. F. Dyer of the Aluminum Castings Co.; J. E. Diamond, engineer for the Aluminum Castings Co.; A. H. Doolittle, sales and advertising manager of the Zenith Carburetor Co.; W. B. Stout, manager the aircraft department of the Packard Motor Car Co.; A. I. Stevens of the N. Z. Graves Corp.; C. L. Nedoma of the Chalmers Motor Co.; L. V. Spencer of E. E. McCrone & Co.; L. B. Fijux, branch manager of the Bijur Motor Lighting Co.; H. A. Brown, sales engineer of the Hyatt Roller Bearing Co.; R. T. Middletown, branch manager for the Steel Products Co.; W. C. Keys, assistant engineer of the Cadillac Motor Car Co ; C. T. Myers, consulting engineer, and O. E. Hunt, chief engineer the carriage division of the Packard Motor Car Co.

The program will be started by a speech from Russell Huff, president of the Society, who will introduce D. McCall White, who will be toastmaster for the occasion. Other speakers will include Coker F. Clarkson, general manager of the S. A. E.; Job Hedges of New York; Captain L. E. Goodier, Jr., of the aviation service; H. M. Leland, president of the Cadillac Motor Car Co., and Howard Coffin, director of the Hudson Motor Co., besides a number of others who are expected to signify their assent shortly.

Lozier Brothers Co. Announces New Cars and Officers

PHILADELPHIA, Dec. 11—The Lozier Brothers Co., recently formed with a $1,000,000 capital to build a four at $785 and a six at $1,595, announces its officers and directors as follows: H. A. Lozier, president; G. P. Grandfield, vice-president, former first assistant United States postmaster general; H. S. Evans, treasurer, manager of the International Time Recording Co., Philadelphia; P. E. Remington of New York; H. C. Shober, vice-president of the National Bank of Huron, S. D.; F. M. Byrne, Governor of South Dakota; Roswell Davis, president of the First National Bank, Freeport, L. I., N. Y.; Hugh Herndon, New York lawyer; Kern Dodge, consulting engineer, Philadelphia, and a director in the Link-Belt Co., Chicago, and James Levy, Chicago. The four-cylinder car will be featured with a 3⅜ by 5¼ valve-in-head engine, Stromberg carbureter, Remy distributer, thermo-syphon cooling, semi-elliptic springs, 32 by 3½-in. tires, and a 112-in. wheelbase. The six-cylinder model will have a 3½ by 5½ valve-in-head engine, Bosch magneto, 34 by 4½-in. tires, and a 127-in. wheelbase.

General Engineering Directorate Completed

DETROIT, Dec. 8—At a meeting of the stockholders of the General Engineering Co., this week, the organization of the directorate was completed. The members of the board include Abner Doble, J. H. French, M. J. Hammers, C. L. Lewis, A. W. Russel and W. F. Trant. Officers elected were C. L. Lewis, president; Abner Doble, vice-president, and M. J. Hammers, secretary and treasurer.

Bucyrus Rubber Elects Directors

BUCYRUS, OHIO, Dec. 7—The following directors were elected at the annual meeting of the Bucyrus Rubber Co., this city: W. A. Blicke, Jacob Coulter, P. H. Heater, Philip Browarsky, A. J. Richards, W. J. Schwenck, A. G. Stoltz, H. A. Paxton and George Donnenwirth.

The company is at present employing forty-five men with a daily output of eighty tires.

$10,000,000 Parts Co. Plans Industrial Town in Los Angeles

LOS ANGELES, Dec. 13—A $10,000,000 parts concern, under the name of the Eisenhuth Motor Co., has been formed and has obtained an option on a 364-acre site at Los Angeles harbor. It proposes erecting a parts and assembly plant, a foundry and factory buildings to construct parts for all makes of automobiles and trucks. It will build everything that enters into automobiles except tires.

J. W. Eisenhuth, president of the company, is a capitalist, formerly of New York and Brooklyn. He states that the project is being financed by eastern capital. Eisenhuth's idea is to surround the factories with an industrial town where living conditions are ideal. He says construction will start next month.

Monroe Buys Four-Story Factory

PONTIAC, MICH., Dec. 13—The Monroe Motor Co. has purchased the four-story factory formerly owned by the Auto Painting & Trimming Co. This acquisition increases the Monroe company's available floorspace by 100,000 sq. ft.

113,000 Overlands on Contract

Valued at $100,000,000—More Than 4600 Dealers Attend Convention

TOLEDO, Dec. 13—During Monday and Tuesday of this week 29,500 cars valued at $25,000,000 were signed for by Willys-Overland dealers in convention at the factory. This makes a total of 113,000 cars worth $100,000,000 taken by dealers since the opening of the convention, Dec. 4. Over 4600 delegates have arrived at the factory.

The convention will continue until Dec. 23, with fresh groups arriving every other day, and John N. Willys, president of the company, believes that the 3 weeks during which the dealers will be in Toledo will mark the sale of 200,000 cars, with a value of $200,000,000, which means that the company's entire output for 1917 will have been contracted for.

The company is doing everything in its power to make the convention a success from both an industrial and entertaining viewpoint.

Willys-Overland Increases Wages

TOLEDO, Dec. 9—Wages of the employes of the Willys-Overland Co., will be increased to total $1,250,000 per year. The wages of companies allied with the Overland company have been increased $225,000 per year at the Electric Auto-Lite Co., $350,000 per year at the Morrow Mfg. Co., of Elmira and $100,000 per year at the Morrow Mfg. Co. at Elyria, Ohio. The rates of increase are:

All rates up to and including 30 cents per hr. will be increased 10 per cent.

All rates over 30 cents and including 40 cents per hr. will be increased 7½ per cent.

All rates over 40 cents per hr. will be increased 5 per cent.

All piece work rates will be increased 5 per cent.

A. O. Smith Raises Wages 10%

MILWAUKEE, Dec. 13—The A. O. Smith Co., this city, has announced a 10 per cent increase in wages for all employees drawing less than $125 per month, effective Dec. 1. This affects approximately 1400 men.

Heinze Concentrates on Ford Starters

SPRINGFIELD, OHIO, Dec. 12—The John O. Heinze Co., manufacturer of starting and lighting apparatus, is at present confining its entire efforts to the manufacture of Ford starters. The factory has a daily capacity of 100 outfits and has 280 employees. The company is manufacturing all of the electrical apparatus entering into these, such as manufacturing its own armatures, doing its own winding, and manufacturing its fixtures and regulators. The company incorporated in July a year ago and started production in March of the present year. It was not until last October that the present rate of production was reached.

Smith Truck Elects Directors

NEW YORK, Dec. 7—The Smith Motor Truck Corp. at its directors' meeting elected the following board of directors: A. D. Smith, E. I. Rosenfeld, A. G. Hanauer, J. M. Hoyt, C. B. Little and Louis Hennock.

Clodio to Concentrate on Houdaille Shock Absorber

NEW YORK, Dec. 12—Paul V. Clodio, until recently senior partner of the firm of Clodio & Engs, metropolitan distributor for Kissel, has resigned from that firm to form the Houdaille Shock Absorber Co., Inc., at 1737 Broadway, New York. Associated with Mr. Clodio as incorporators are John N. Van Vranken and Edwin Rushmore.

The plan is to exploit more widely the Houdaille patents and Mr. Clodio has found it desirable to confine his efforts more closely to the shock absorber, the American rights to the manufacture of which he has controlled for years.

The Houdaille shock absorber is standard equipment on the Mercer cars for 1916 and 1917 and on the Peugeot, Panhard, Delaunay-Belleville and other prominent foreign cars.

Star Prepares to Make Tires

AKRON, O., Dec. 11—The Star Rubber Co. is preparing a plant with 100,000 feet of floorspace for extensive manufacturing of tires. The Star company, organized in 1910, has manufactured to a large extent rubber goods for druggists and surgeons, and in 1916 started manufacturing tires in a small way. The company has been recapitalized at $500,000.

L. H. Firey is president and treasurer. He was for 15 years proprietor of the Coates House in Kansas City. R. R. Robinson, vice-president, is vice-president of the Robinson Clay Products Co., Akron. O. L. Weaver, secretary, was for 10 years with Goodyear, 2 years with Willys-Overland, and the last 4 years northeastern Ohio Pierce-Arrow dealer.

Other prominent stockholders include H. B. Manton, president of the Robinson Clay Products Co.; Francis Sieberling, connected with several Akron rubber companies; I. R. Manton, a director of the Robinson Clay Products Co.; J. P. Loomis, president of the Akron Coal Co., and George D. Bates, vice-president of the First-Second National Bank of Akron.

To Confer on Aeronautics

M. & A. M. and N. A. C. C. Interested—Five New Accessory Members Elected

NEW YORK, Dec. 11—Realizing the important part that aeronautics are destined to play in the future and their close connection with the automobile accessory business, the forthcoming First Pan-American Aeronautic Exposition to be held in Grand Central Palace, New York, Feb. 8 to 15 inclusive, was discussed and acted upon by the executive committee of the M. & A. M. at its monthly meeting in New York, Dec. 8.

Following a talk by Howard E. Coffin, of the Hudson Motor Car Co., and chairman of the Pan-American Aeronautic Exposition, who thoroughly explained the objects of the aeronautical exhibition and aeronautics in general, it was voted to appoint a committee of three to confer with similar committees from the National Automobile Chamber of Commerce, the Aero Club of America, the Pan-American Aeronautic Federation and the American Society of Aeronautic Engineers, at which time the matter of officially approving the aeronautical show will be discussed. Those who will represent the M. & A. M. include President C. W. Stiger, C. E. Thompson, chairman of the show committee, and William M. Sweet, director.

During the past week the M. & A. M. has been elected to membership in the Chamber of Commerce of the United States of America and President C. W. Stiger was elected as national councillor and Vice-President C. E. Thompson as delegate to represent the accessory association in connection with the Chamber of Commerce.

William M. Sweet, chairman of the banquet committee of the M. & A. M., reported in connection with the forthcoming banquet to be held at the Waldorf-Astoria, Jan. 10, that the sale of tickets had greatly exceeded that of any previous year and that it was expected that the 1917 banquet would be the most successful in the history of the M. & A. M.

Five new members were elected, making a total membership of 263 manufacturers of motors, part and accessories.

The new members are: Automatic Carbureter Co., Chicago; Superior Lamp Mfg. Co., New York; Amalgamated Machinery Corporation, Chicago; Warner & Swasey Co., Cleveland, and the Metal Stamping Co., Long Island City.

Those present at the meeting were C. W. Stiger, president of the Stromberg Motor Devices Co., Chicago; C. E. Thompson, president of the Steel Products Co., Cleveland; E. H. Broadwell, vice-president of the Fisk Rubber Co., Chicopee Falls; Christian Girl, president of the Perfection Spring Co., Cleveland; W. O. Rutherford, general sales manager of the B. F. Goodrich Co., Akron; William M. Sweet, assistant to president of the United Motors Corp., New York; Sidney S. Meyers, counsel of the M. & A. M., and L. M. Bradley, manager.

Kearns Is Lee Tire Manager

CONSHOHOCKEN, PA., Dec. 8—John Kearns has become general manager of the Lee Rubber & Tire Co. He was the organizer of the British Dunlop Co. of Australia. Mr. Kearns comes from the Fisk Rubber Co., Chicopee Falls, Mass., where he was vice-president.

Jackson Is Briscoe Comptroller

JACKSON, MICH., Dec. 13—W. V. C. Jackson has been appointed comptroller of the Briscoe Motor Corp. Mr. Jackson was formerly general manager of the motor wheel division of the A. L. Smith Co.

Kellum with Columbia Motors

DETROIT, Dec. 8—E. F. Kellum has been appointed as purchasing agent for the Columbia Motors Co. Mr. Kellum was formerly associated with the Weston-Mott Co., of Flint. G. J. Martin has been appointed auditor for the Columbia company. Mr. Martin was formerly deputy city comptroller of South Bend, Ind.

Rahan To Make Ford Starters

DETROIT, MICH., Dec. 12—Electric starters will be made for Ford and other cars by the Rahan Co., which is incorporating Jan. 15 under the laws of Michigan for $100,000.

It is a 12-volt, two-unit system made in straight line form, the generator and motor shafts being co-axial. The patents under which the machine is being made are held by Frank B. Rae, and the principal one is No. 1,153,338 on a transmission mechanism. This is a missing tooth differential operated by a cone which at the apex end terminates in an offset ball connection to the driving shaft and at the base end carries upon its periphery a set of gear teeth, one less in number than the set with which it meshes on the driven side. The device as arranged on the standard unit gives a 30-1 reduction.

The starting motor is series wound and has an over-running ball clutch engagement. It gives 81.6 ft. lb. stalling torque, it is said, with a weight of 42 lb. It is largely made from stampings and die castings. It is regulated by magnetic control. The generator has a charging rate of from 7 to 15 amps., cutting in at 8 m.p.h. The outfit for Fords will sell for $50.

Tanks for U. S. Army

Will Have Two Revolving Turrets, Armored Machine Guns and Motorcycles

WASHINGTON, Dec. 11—Chief of Ordnance of the Army Crozier, in a report just made, declares that the United States Army soon will be equipped with caterpillar tractors similar to those in use in the British army, the so-called "tanks." The report of General Crozier says armored cars, with two revolving turrets, mounted with machine guns; armored machine guns, equipped motorcycles and individual armor for the men of the ranks, also are under consideration.

Along this line the quartermaster general of the army, in a report, shows that $2,175,000 was spent by the army on motor truck equipment alone after the expedition was ordered into Mexico in pursuit of Villa.

The quartermaster general, in testifying before the House military committee, said that the use of trucks for transportation purposes has more than tripled the mobility of troops. He added that had General Pershing only mule trams to use in moving his command he could not have traveled half the distance he did in Mexico.

Col. Chauncey Baker of the Quartermaster's Corps testified that a motor truck made from 60 to 120 miles a day against a possible maximum of eighteen for mule teams. A four-mule team, he added, would eat in 4 days all the fodder it could haul. It was shown by Colonel Baker that the army now has 2600 motor trucks of several satisfactory types, and that the machines show less than 20 per cent depreciation in efficiency, despite the severe tests imposed by the hard service they were put to.

Representative Julius Kahn told the committee he was told by Brig-Gen. Franklin J. Bell that it would be possible to put 50,000 men into Chihuahua City in 2 days by motor truck.

Indorse 42-In. Head-lamp Law

NEW YORK, Dec. 8—A conference on the head-lamp situation was held at the S. A. E. office here to-day, among those present being A. Reeves, National Automobile Chamber of Commerce; A. G. Batchelder, A. A. A.; Elmer Thompson, Automobile Club of America; C. A. Stewart, Motor Dealers' Association; A. Ludlow Clayden, chairman S. A. E. standards committee, and Alden McMurtrie, consulting engineer, who has made many experiments with automobile lighting. It was agreed that the limitation of head-lamp rays to rise not more than 42 in. above the road at a distance of 75 ft. or more in front of the car was a solution of the difficulty which was desirable. It is easy to make lamps which will conform to and to adjust existing lamps to suit a regulation of this sort. What is required is a much more general spreading of the knowledge of how to focus and set head-lamps. It was remarked that of all instruction books issued by automobile manufacturers, very few indeed gave any instructions for focusing a lamp, although this is almost as important as adjusting a brake. Thus it seems that the chief work of the different bodies representing automobilism will be to educate users of cars, dealers, repairmen and manufacturers into the art of lamp adjustment. The work now being done by the S. A. E. committee in an experimental way will benefit the manufacturer most of all by indicating how to make lamps in the future that will require a minimum of adjustment.

Win Temporary Injunction Against Ford

DETROIT, Dec. 9—A temporary injunction, restraining Henry Ford and the Ford Motor Co. from the erection of a $12,000,000 blast furnace plant was granted in behalf of John F. and Horace E. Dodge by the Wayne county circuit court in the decision rendered to-day in their suit against Henry Ford. The extensions to the Ford plant, now in process, are not affected by the decision. The judges recommended that the suit come to a hearing on its merits within 60 days.

The suit will come before the court again Dec. 13, when counsel for both sides will appear before Judg Wiest to arrange for carrying out the conclusions of the judges.

Two Ghent Models for 1917

CHICAGO, Dec. 13—The Ghent Motor Co., Ottawa, Ill., will bring out a four at $750 and an eight at $1,050 in 1917. Both models are touring cars. The four will use an L-head 3¾ by 4¼-in. motor, developing 37 b.hp. Oiling is accomplished by force feed and splash system. It also uses the model R Schebler carbureter with hot air stove and the electrical system is the three-unit Gray & Davis. A 6-volt starting and lighting and manual control ignition system with a 90-amp. hr. storage battery and a motor-driven horn are used. Rear axle is floating and the drive is Hotchkiss. Springs are semi-elliptic, both front and rear. The wheels are Parker hydraulic pressed steel. The body has the center cowl with straight stream line from radiator back. The windshield is set at an angle of 25 deg.

With the exception of the rear axle, which is three-quarter floating, the specifications of the eight are practically the same as the four.

Military Tractor Train Tested

U. S. Government Makes Exhaustive Test in Texas of Caterpillar Type

MARFA, TEX., Dec. 7—The initial test run of the military tractor train recently received here from Peoria, Ill., for use in the Big Bend region of the upper Rio Grande border, has just been finished. The run was made over a rough stretch of country, and is said to have come up to the army requirements in every way. The test was conducted under the direction of Capt. H. A. Hegeman, quartermaster in charge of the motor truck shops at Fort Sam Houston.

The run was made between Marfa and Presidio, a distance of 63 miles, over a desert, rough region where water is scarce. The equipment consisted of a 75-hp. caterpillar tractor and four trailers, each equipped with caterpillar tread instead of wheels. Each trailer had a cargo-carrying capacity of 15 tons.

The trip was made at an average speed of about 2½ m.p.h. over a road that is a road in name only. The train was loaded to full capacity with supplies on its outgoing trip. Captain Hegeman will make a complete report on the trial trip to Col. H. L. Rogers, chief quartermaster of the Southern Department, with headquarters at Fort Sam Houston.

Anderson Motor Co. Incorporates

ROCK HILL, S. C., Dec. 8—The Anderson Motor Co., this city, maker of the Anderson car, has incorporated with a capital of $1,500,000. The incorporators are J. B. Johnson, J. G. Anderson, T. L. Johnston, J. M. Cherry, Alex Long and J. W. O'Neal, all of this city, and J. A. Carr of Birmingham.

United Takes Over Fairbanks Hammers

BOSTON, Dec. 9—The United Hammer Co., this city, has purchased the power hammer business of the E. & T. Fairbanks & Co., St. Johnsbury, Vt., which marketed them under the name of Dupont. In 1902 the business was taken over by E. & T. Fairbanks & Co., which has been manufacturing them since.

Willis Is Hal Vice-President

DETROIT, Dec. 11—F. B. Willis, who recently resigned as sales manager for the Chalmers Motor Corp., has become the vice-president of the Hal Motor Co., of Cleveland. Mr. Willis will be in charge of the sales, service and advertising and in addition will be assistant to the president of the company.

South Is Buying More Cars

States There in Sound Financial Condition—Good Roads Promote Sales

ATLANTA, GA., Dec. 7—The South is buying more automobiles this year than in any time in its history. A comparison of automobiles shipped this year reveals an increase of nearly one-half over that of last year. The sounder financial condition of the Southern States is largely responsible for the increased shipments.

Twenty cent cotton has done much toward filling the coffers of the South. This condition holds with especial force for the planters in Georgia, Alabama, and Texas. But turpentine as much as cotton is cutting a figure in southern incomes. The discovery of the use of resins in the production of synthetic leathers and harder products like Bakelite has boomed the turpentine industry. Old stills that have been abandoned for years have reopened, and both owners and commission men find themselves buyers of automobiles.

In other parts of the South, diversified farming is demonstrating its profitableness. Grain crops and stock at new price levels are adding materially to farm revenues. This fact holds true particularly in Texas, where many of the smaller landholders in the last 2 years have become prospects for medium-priced automobiles.

Kokomo Rubber Refinanced

NEW YORK, Dec. 11—The Kokomo Rubber Co., Kokomo, Ind., organized in 1895 with a capital of $200,000, will soon incorporate under the laws of New York under the name of the Kokomo Tire Co. and will have a capital of 100,000 shares of stock of no par value. Fieldsteel & Co., this city, will underwrite 25,000 shares, 25,000 shares will be offered to stockholders and 50,000 will be held in the treasury.

This company, which has been manufacturing bicycle tires extensively, will develope its automobile tire business. It also manufactures automobile tubes. The officers will remain unchanged.

Annual earning, it is stated, will approximate $550,000. The old company has paid out $600,900 in cash dividends and $135,000 in stock dividends.

Decker Buys Universal Car Equipment

DETROIT, Dec. 11—The Decker Auto Top Co. has purchased the Universal Car Equipment Co., this city. The combination continues business as the Universal Car Equipment Co. The new combination is moving into a factory of its own with much larger manufacturing facilities.

Four Wheel Takes Over Utility

CLINTONVILLE, WIS., Dec. 11—The Four Wheel Tractor Co. has taken over the Utility Steel Tractor Co., Antigo, Wis., and will market the Utility tractor with improvements. David S. Stewart, who invented the Utility tractor, has opened an electric theatre in Appleton, Wis.

S. O. Raises Gasoline Prices

CHICAGO, Dec. 8—The Standard Oil Co. of Indiana has advanced the price of gasoline 1 cent a gallon to 16½ cents in all of its territory. In the Kansas City district Standard Oil and the independent companies have advanced prices 1 cent a gallon to 15.8 cents, tank-wagon basis.

Another increase of 1 cent a gal. in gasoline in 10 days has been made in Milwaukee, Wis., by the Standard Oil and independent companies. Current quotations are: 59-deg., 17.6 cents and 16.6 cents, filling station and tank wagon delivery respectively; 62-deg., 21 and 20 cents; 65-deg., 25.5 and 24.5 cents. Los Angeles prices have gone up 1 cent to 20 cents retail. The standard Oil and Union Oil companies are the leaders in the movement and so-called independent producers follow suit. The price of gasoline in Southern California has been raised 9 cents a gal. in the last 14 months.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Change
Aluminum, lb.	.63	.63	.63	.63	.63	.63	...
Antimony, lb.	.14	.13	.13	.13	.13	.13	— .01
Beams and Channels, 100 lb.	3.37	3.87	...	3.42	3.42	3 42	+ .05
Bessemer Steel, ton	55.00	55.00	55.00	55.00	55.00	55.00	...
Copper, Elec., lb.	.35	.35	.35	.35	.35	.35	...
Copper, Lake, lb.	.35	.35	.35	.35	.35	.35	...
Cottonseed Oil, bbl	12.70	12.84	12.79	12.70	12.64	12.30	— .40
Fish Oil, Menhaden, Brown, gal.	.72	.72	.72	.72	.72	.72	...
Gasoline, Auto, bbl	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb	7.75	7.75	7.85	7.90	7.90	8.00	+ .25
Linseed Oil, gal.	.93	.95	.95	.95	.94	.94	+ .01
Open-Hearth Steel, ton	55.00	55.00	55.00	55.00	55.00	55.00	...
Petroleum, bbl., Kan., crude	1.00	1.00	1.00	1.00	1.00	1.00	...
Petroleum, bbl., Pa., crude	2.75	2.75	2.75	2.75	2.75	2.75	...
Rapeseed Oil, refined, gal.	.98	.98	.98	.98	.98	.98	...
Rubber, Fine Up-River, Para, lb.	.79	.79	.79	.80	.80	.81	+ .02
Rubber, Ceylon, First Latex, lb.	.76½	.78	.84	.82	.84	.83	+ .06½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1 50	1.50	...
Tin, 100 lb.	44.50	44.00	43.75	43.50	43.50	43 25	—1.25
Tire Scrap, lb.	.06¼	.06¼	.06¼	.06¼	.06¼	.06¼	...

Rubber Prices Are Higher

Para Reaches 98 Cents a Lb. and Ceylon 81 Cents—Crude Oil Quoting High

NEW YORK, Dec. 12—Rubber prices featured this week's activities in the automobile materials market. Prices fluctuated and closed yesterday higher. Para rose 2 cents a lb. to 81 and Ceylon rose to 83 cents a lb., a net gain of 6½ cents. Shipments have not been regular of late with the consequent rise. Lead prices went up 25 cents a 100 lb. to $8.00. Linseed oil rose 1 cent to 94. Tin dropped $1.25 per 100 lb. to $43.25.

The advance in rubber is attributed to several causes. The chief one is said to be the great delay experienced in ocean transportation between the Far East and London. Formerly, under normal conditions, a shipment of rubber could be brought from London in 45 days. Under present conditions it is not unusual for a cargo to be in transit for 3 months. There has been great delay also between London and New York. Against a voyage of seven days, often twenty-five days have been required in recent months.

In spite of an increased production of plantation rubber, these conditions have enabled speculators in London, and to some extent in this city, to bid up prices without buying very much of the product. Stocks in London are not large, but consumers in this country are said to be fairly well supplied.

It is estimated that the yield of plantation rubber for 1916 will be 160,000 tons, against 107,000 tons in 1915.

Crude oil prices are at present the highest in twenty years. The new production is small in volume, and the cost of drilling the wells is quite heavy. Pennsylvania crude oil is quoting at $2.75 per barrel. The previous record price was in 1895, when it was quoted at $2.60 a barrel. Indications point to $3 a barrel shortly.

Continental Asks for Stock Issue

DETROIT, Dec. 11—Stockholders of the Continental Motors Co. will be asked by the board of directors to approve a plan by which $15,000,000 common stock and $3,500,000 preferred will be issued. Each common stockholder will receive three shares for each share now held and $5 cash.

It is stated by the company that the purpose of the plan is to provide sufficient working capital to meet the needs of the concern. In addition, $1,000,000 funded debt will be paid off. The outstanding preferred stock of the company will be retired or exchanged for new preferred stock. There is $472,300 preferred outstanding.

In their letters to the stockholders the company directors state that they have refused offers for control of the capital stock of the company. The plan, they say, has been approved by stockholders having 80 per cent of the stock. The directors have placed their stock with the Security Trust Co., which will act as depository, and ask that other stockholders do likewise.

Under the plan, a new committee will be formed under the supervision of a committee composed of B. F. Tobin, R. W. Judson, H. J. Warner and A. H. Zimmerman. The new stock issue will be handled by William P. Bonright & Co. and Lee, Higginson & Co. It is stated that the common stock taken by the bankers will be held for investment and will not be offered to the public.

Dividends Declared

Willys-Overland Co., regular quarterly of 1¾ per cent on preferred, payable Jan. 2 to stock of record Dec. 20.

E. & J. to Pay Dividend

DETROIT, Dec. 12—The Edmunds & Jones Corp. will pay its third dividend on Dec. 20, amounting to 1¾ per cent on the preferred stock and $1 per share on the common stock, according to a statement by G. D. Edmunds, president.

Pierce-Arrow Pfd. on 8% Basis

NEW YORK, Dec. 13—The Pierce-Arrow Motor Car Corp., Buffalo, has declared an initial dividend of 2 per cent, putting the stock on an 8 per cent per annum basis. This dividend will be payable Jan. 2 on stock held from Dec. 6 to Dec. 31, inclusive. Quarterly dividend payments will be made in January, April, July and October.

Securities Drop on Peace News

Chevrolet Drops 20 Points—United Motors 2 Points Lower—Market Weak

NEW YORK, Dec. 13—News of Germany's peace proposals was the cause of the widest break in stocks in the last 2 years. Heavy selling on the part of professionals was followed by liquidating orders from the commission houses. This selling movement continued until noon, when more than 1,000,000 shares had changed hands. After the second wave of selling, both on the Stock Exchange and the Curb, had receded, motor issues were found to have suffered badly.

Chevrolet was the largest loser with a drop of 20 points, General Motors dropped 7 points, and United Motors dropped 2 points. Stutz went down to 63, National dropped 2 points to 36, and Springfield Body common had a similar drop to 85.

Before the German news had been published, that is, for the week ending Saturday, automobile stocks were fairly active and higher. Ajax Rubber featured the market with a gain of 16½ points on the strength of the deal with the Racine Rubber Co., which is planned to be taken over by it. Ajax Rubber is now quoting at 86½. Stewart-Warner stock will be listed on the Stock Exchange.

Hayes Capital Now $1,500,000

DETROIT, Dec. 13—The Hayes Mfg. Co., body builder, this city, is increasing its capital to $1,500,000. The present capital consists of $500,000 in common, $135,000 preferred, and $60,000 in bonds. The company has a surplus of $440,000 for this year. A part of the increase in capital is a 75 per cent stock dividend, $625,000 worth of stock being issued in all. Earnings for the 5 months of the current year are $114,000.

Harrison Radiator Granted Charter

ALBANY, N. Y., Dec. 8—The Harrison Radiator Corp., Lockport, N. Y., has been granted a charter to manufacture radiators, parts and accessories. It is capitalized with 20,000 shares, half of no par value. It will carry on business with $1,050,000. The directors are Beononi Lockwood, F. A. Gaynor and R. G. Coad. This company was recently taken over by the United Motors Corp.

Phelps Capital to Be $400,000

COLUMBUS, OHIO, Dec. 9—The capital stock of the Phelps Mfg. Co. will be increased from $100,000 to $400,000 in the near future. The company is manufacturing wire wheels for automobiles.

Paige-Detroit Issues $1,000,000 Preferred Stock

NEW YORK, Dec. 8—The Paige-Detroit Motor Car Co., Detroit, has issued, through Chandler & Co., this city, $1,000,000 of 7 per cent cumulative preferred stock, par value $10 a share. The amount authorized is $1,500,000. The Paige-Detroit company also has $2,000,000 of common, par value $10, of which $1,500,000 has been issued.

The preferred stock will be redeemed at par and accrued dividends at the rate of $100,000 annually, beginning with Jan. 1, 1918, and ending with Jan. 1, 1927.

For the 13 months ended Dec. 31, 1916, the net income available for dividends was $609,755; for the 10 months ended Oct. 31, 1916, $964,442. Ten months'

Automobile Securities Quotations on the New York Stock Exchange

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	86¼	86½	+16½
J. I. Case T. M. Co. pfd	86¼	89½	— ¾
Chalmers Motor Co. com	135	..	..
Chalmers Motor Co. pfd	105	115	—5
*Chandler Motor Car Co.	110	112	—1
Chevrolet Motor Co.	170	180	+5
Fisher Body Corp.	38	41	..
Fisk Rubber Co. com	70	80	—10
Fisk Rubber Co. 1st pfd	100	110	—10
Fisk Rubber Co. 2d pfd	90	100	..
Firestone Tire & Rubber Co. com	150	152	—12
Firestone Tire & Rubber Co. pfd	106½	107½	— ½
*General Motors Co. com	650	800	..
*General Motors Co. pfd	113½	120	—6½
*B. F. Goodrich Co. com	68¼	68¾	—1½
*B. F. Goodrich Co. pfd	111	111⅛	..
Goodyear Tire & Rubber Co. com	293	296	..
Goodyear Tire & Rubber Co. pfd	109	109¾	+ ¼
Grant Motor Car Corp.	7	9	—1
Hupp Motor Car Corp. com	3½	4½	— ¼
Hupp Motor Car Corp. pfd	80	100	..
International Motor Co. new com	14	18	..
International Motor Co. 1st pfd	60	80	+12
International Motor Co. 2d pfd	30	50	+7
Keystone Tire & Rubber	15¼	15½	— ¼
*Kelly-Springfield Tire Co. com	72¾	73	—2¼
*Kelly-Springfield Tire Co. 1st pfd	95	99½	..
*Lee Rubber & Tire Corp.	31¼	32¼	—5¼
*Maxwell Motor Co. com	70⅝	71½	—2¼
*Maxwell Motor Co. 1st pfd	79⅛	79½	—2¼
*Maxwell Motor Co. 2d pfd	47	50	—2
Miller Rubber Co. com	253	258	—2
Miller Rubber Co. pfd	106	108	—2
Mitchell Motors	55½	55¾	..
Packard Motor Car Co. com	173	183	—5
Packard Motor Car Co. pfd	101	103	—3
Paige-Detroit Motor Car Co.	41½	42½	—2½
Peerless Truck & Motor Corp.	21	23	—1
Pierce-Arrow	55⅛	55½	..
Portage Rubber Co.	174	..	—7
Regal Motor Car Co. pfd	20	30	..
Reo Motor Car Co.	45¾	46¼	— ⅛
Saxon Motor Car Corp.	76	77	..
A. O. Smith Corp. com	41½	42	..
A. O. Smith Corp. pfd	96½	91	+1
Springfield Body Corp. com	95	105	+10
Springfield Body Corp. pfd	120	130	..
Standard Motor Construction Co.	6⅛	7	+ ⅛
Stewart-Warner Speed. Corp. com	..	..	..
Stewart-Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	108½	110	—11½
*Studebaker Corp. pfd	..	..	..
Stutz Motor	63¾	63½	+ ¾
Swinehart Tire & Rubber Co.	..	88	..
United Motors Corp.	59½	59¾	—1
*U. S. Rubber Co. com	68¾	69	—3
*U. S. Rubber Co. pfd	113	113½	— ½
White Motor Co	53	54	— ¾
*Willys-Overland Co. com	38	38½	+1⅛
*Willys-Overland Co. pfd	99	99⅜	+ ⅜

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*At close Dec. 11, 1916. Listed New York Stock Exchange.

operations show net earnings of more than thirteen times the annual preferred dividend requirements.

The company's output has increased from 267 cars in 1910 to 12,456 cars for the year 1916 up to Nov. 25.

McCord $1,000,000 Stock Issue

DETROIT, Dec. 14—McCord Mfg. Co. has authorized an issue of $1,000,000 in 7 per cent cumulative preferred stock, of which $750,000 will be offered at once, and also 75,000 shares of common stock of no par value for immediate issue. The brokers handling the issue are John Burnham & Co. of New York, and E. E. McCrone & Co. of Detroit.

To List Paige-Detroit on Curb

DETROIT, Dec. 8—Paige-Detroit stock will soon be listed on the New York curb, according to statements made by reliable Detroit sources.

Rickenbacher Sails for Europe

NEW YORK, Dec. 12—Ed. Rickenbacher, racing driver, sails for Europe Saturday to visit England, France and Italy to purchase two racing cars for next year's campaign in this counrty. He goes as a representative of Wm. Weightman, Kenova, Va., who made his debut in racing by driving a Duesenberg in the Astor Cup Race and later won third place in the recent Vanderbilt Cup Race in a Duesenberg. Rickenbacher expects to take the matter up with the Sunbeam Co. and has been approached by that organization to drive for them next summer. He prefers however to purchase cars outright. It is expected that he will visit Fiat and one or two of the French makers.

Boston to Have Salon

BOSTON, Dec. 9—Manager C. I. Campbell of the Boston automobile show today leased the ballroom of the Copley Plaza Hotel for the week of the Boston show in March to hold the automobile salon. While the Mechanics' Building exhibit is to open Saturday night, the salon will not open until Monday night. The exhibitors in the salon will be members of the Boston Automobile Dealers' Association. There will be a limit of not more than two cars for each dealer. Another restriction limits the exhibits to limousines, landaulets, coupes, sedans, etc., with the exemption that no open touring car whose price is less than $2,500 will be admitted.

Two More Show Exhibitors

NEW YORK, Dec. 12—The Craftsman Motor Co., Chicago, will be an exhibitor at both national shows. The Superior Lamp Mfg. Co., New York, has just been given space at the New York show.

Safety First Advocates Education

Punishment of Traffic Violators Censured at 3-Day Session of Association

BALTIMORE, MD., Dec. 7—Education will do more toward reducing accidents than punishing violators of traffic rules. Such was the keynote of the annual convention of the Safety First Federation of America, which opened a three-day session here to-day. With the ever-increasing volume of automobiles on our streets comes a corresponding increase in the traffic chaos of busy thoroughfares and a consequent need for more ease of movement of vehicular traffic and the necessity for extreme care on the part of pedestrians and operators of automobiles and horse-drawn vehicles alike.

Perhaps the one great message that was brought to the convention came with Joseph Sabath, now superior judge of Cook County, Ill., and former head and originator of the speeders' Court in Chicago. Judge Sabath's experience in handling some 20,000 cases in the speeders' court has given him a knowledge of motor traffic such as is possessed by few, if any, other individuals. It is his opinion that the problem confronting a judge in his former position requires something more than a cold administration of the law, the exacting of fines and penalties, the adding of revenue to the city treasury, something that the administration of the law does not reach—the question of guarding human life. "The levying of fines and penalties is insignificant," said Judge Sabath, "compared with the real service a judge in such a court can render the community if he takes the problem seriously and devotes himself to a study of the question and urges such remedies as his experience shows him to be best for all concerned."

In his plea for education as a substitute of penalization, Judge Sabath declared that the man who is fined usually leaves the court room defiant. His penalty is paid and he owes nothing more to society. However, if the judge patiently and earnestly points out to him the seriousness of his offense, because of its danger to society, his better self responds and he becomes a champion of the work the court is doing.

Summing up, Judge Sabath said that no mercy should be shown an intoxicated driver of a car, for he is a real menace, and a prison sentence should be meted out to him. Among other things he advocated as being necessary for greater safety on our streets are the abolishment of glaring headlights, better regulation of motorcycles, licensing of every person driving a car and the establishment of a special court in each city to handle violations of the traffic rules and run along educational lines.

Several speakers at the convention advocated that all vehicles be brought to a full stop a certain number of feet—preferably ten—back of a street car that has stopped to take on or discharge passengers, unless there is a safety zone or the street is sufficiently wide to allow the vehicle to pass and give passengers 8 to 10 ft. of space between the car and the vehicle passing.

Education both of the pedestrian and the vehicle operator in the principles of Safety First was the prevailing thought expressed.

Studebaker Six Has 122-In. Wheelbase

NEW YORK, Dec. 13—The wheelbase of the 1917 six-cylinder Studebaker is 122 in., and that of the four-cylinder model is 112 in. In the description of these cars published in THE AUTOMOBILE last week the four was incorrectly given as 102 in. and the six as 112.

Harkness Resigns as Sheepshead President

NEW YORK, Dec. 12—Harry S. Harkness has resigned as president of the Sheepshead Bay Speedway Corp., to take effect at once. No reason is given for his resignation. The speedway made little money this year and Mr. Harkness and other heavy stockholders were obliged to put up much money to cover the heavy expenses.

Analyzes After-War Conditions

(*Continued from page* 991)

will enjoy greater industrial stability resulting from a broader market."

Laws Must Change Slightly

The present laws, the report says, in many cases as they stand operate to prevent formation of co-operative organizations for export trade. Changes must be made, it says, to relieve the manufacturer of even doubt as to their application in foreign trade organization, but leaving them as at present to protect the domestic consumer against combinations to control prices.

Probably the most important part of the report is that which goes into detail touching the question of legislation under which the American exporter may be protected in his business, once peace is restored abroad.

Several months ago a preliminary report along this line was made by the Trade Commission, and following this action Representative A. Y. Webb, chairman of the House Judiciary Committee, introduced a bill covering the recommendations made by the commission. Mr. Webb said to-day that he is prepared to push his bill at the present session of Congress.

The trade report suggests that unnecessary alarm is being felt by American exporters just at this time because of the fact that high costs of raw materials, increased taxes, probably higher wages, to say nothing of the capital and stocks of material necessary to repair the wastages of war, are expected to delay the full power of European competition until it regains its normal state. But laws to put the American exporter on a footing with his foreign rival by authorization of collective foreign selling agencies are recommended.

In studying the export situation the trade commission, it is declared, has tried to take the problem in its broad, historical aspect, considering the present war as a temporary interlude, the permanent influence of which it is difficult to estimate.

Competition Will Be Sharper

"It is frequently asserted," says the report, "the manufacturers and producers of the belligerent countries will take effective measures to regain their former trade. Such foreign manufacturers and producers may be expected to fully utilize their highly efficient organizations for the promotion and handling of trade beyond their borders, even foregoing profits or taking a very low profit till their costs again become normal and they have re-established their trade. Hence, competition from foreign industrial combinations, aided by foreign ship lines and foreign banks, and backed by foreign governments, may be even sharper than before the war."

Other Countries Considered

The report takes up competitive conditions in most of the countries of the world, devotes a chapter to competition in South America, gives competitive conditions in particular industries, and carries a mass of tables and statistical data concerning trade conditions everywhere.

Detroit Show Space All Sold

DETROIT, Dec. 8—Every square foot of floor-space for the 1917 Detroit automobile show has been sold. More space is available at the Billy Sunday tabernacle where the coming show will be held, than was at the disposal of the Detroit Automobile Dealers' Assn. last year but demands have been so great that members have been held down on space and non-members have been forced to tak cut allowances in order to partially meet the demand. As it is, there will be many pleasure car dealers and accessory companies who will be unable to display their exhibits.

Battery Service Discussed

Ind. Service Managers at Meeting—Advocate Co-operation by Garages and Owners

INDIANAPOLIS, IND., Dec. 10—Closer co-operation on the part of garage men and automobile owners with manufacturers as a means of eliminating many storage battery problems as they relate to starting and lighting systems was recommended at the regular monthly meeting of the Indiana Automobile Service Managers' Assn. held here last night. The meeting was attended by about seventy-five persons with members of the Indiana section of the Society of Automobile Engineers as guests.

"The Battery Service Problem" was the subject of a paper read by J. Whyte, service manager of the Prest-O-Lite Co. H. S. Bentley of Cleveland, manager of agents of the Willard Storage Battery Co., read a paper entitled "Proper Care of Batteries on Cars Held in Stock."

The chief topic of discussion among the service managers was the cold weather problems that result from the lack of care of storage batteries, and as a result of this discussion car manufacturers were asked to request their service men, agents, and owners to make the following recommendation for starting cars in cold weather:

> Throw the clutch out—do not keep it in neutral position—while trying to start engines in cold weather. By throwing out your clutch you relieve your starting battery of a heavy load, thereby increasing the efficiency of your starting system.

The service managers expressed the belief that not one motorist out of twenty-five knows of or practises this simple rule which would accomplish much in the elimination of battery and starting system troubles.

Earle & Boggs Take Buda Motor

NEW YORK, Dec. 12—Earle & Boggs, 1790 Broadway, New York City, manufacturers' representatives carrying a general line of automobile materials, have been appointed representatives of the Buda Co. in the East.

P. O. Bans Newspaper Publicity

(*Continued from page* 992)

and a similar article which might be an advertisement," said General Dockery. "Cases have been brought to our attention in which these alleged news items, undoubtedly written by the same fellow, have appeared in different publications. Therefore, in view of all the facts, while not saying the newspapers are violating the law, in view of complaints being made we are investigating.

"The construction of this law is very clear, and likewise the evident intention of Congress is very clear. Otherwise, Congress would not have gone so far as to make the violation of it a criminal offense, in addition to the denial of second-class mail privileges to the offenders. This particular feature is a part of the section of the law which calls for the publication, ever so often, of sworn statements as to ownership and circulation. As I said before, I hope the letters I am sending out, together with the possibility that I may have to call some of the offenders before me, will suffice. If not, I am then required by the law to have recourse to the courts, and the procedure would be to refer my complaints, together with the information obtained by me, to the United States District Attorneys in the territories where offenses seem to have been committed."

General Dockery then continued to discuss in an interesting manner his views as to the line of demarcation already referred to. He said, in this connection, that if a news notice and a display advertisement are run at the same time, and the two are apparently connected, the natural presumption would be that the news notice is in effect an advertisement, and if not so marked would be a violation of the law.

Traffic Men Indorse N. A. C. C. Methods

DETROIT, Dec. 13—Twenty-five traffic managers of leading automobile companies met here yesterday and voted to approve the methods of the National Automobile Chamber of Commerce traffic department for relieving freight congestion.

Madison Square Garden Sold

NEW YORK, Dec. 11—Madison Square Garden, the cradle of the automobile industry and the scene of exhibitions and spectacles of all descriptions for the last twenty-six years, has been put up on the block. Last week it was sold for $2,000,000 to the New York Life Insurance Co. Lovers of the staid old structure had visions of a modern building in its place, but the insurance company has since expressed its intention of selling it, so there is a slight chance that the building will continue to be for exhibition purposes.

In Madison Square Garden was held the first automobile show of this country. This was in 1900, and for thirteen consecutive years the place was the setting for the local national show. Each time since that rumors claimed the sale of the Garden. When the industry enlarged and more room was needed to harbor the show, a worthy successor to the historic old building was found in the Grand Central Palace.

The Automobile

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Carbureter Demands

THE attitudes of the purchasing agent and the engineer of an automobile factory are typical of the problems the carbureter maker of to-day has to solve. The purchasing agent looks upon the carbureter as a necessary piece of brass which must be bought to make the car complete, but which, like all other equipment, must be bought at the lowest possible figure.

On the other hand, there is the engineer, who knows he has a fine power plant, but must have the best possible carbureter in order to bring out the power of which it is capable. He wants 3 m.p.h. on high. He wants quick starting after a night in a zero-temperature garage. He demands acceleration from 3 to 30 m.p.h. in a city block, and all this at a reasonable economy figure and with a high peak on the power curve.

To meet these standpoints of the purchasing agent and of the engineer offers a problem that does not tempt the faint-hearted. In fact, more than one carbureter maker who believes that he has a good instrument will not even attempt to bid for factory business. Instead these manufacturers go after the retail trade, and more than one are successful.

To be a commercial success, however, the carbureter of to-day is like the rest of the car. It must not only be designed to do its work in the best possible manner, but it must be a commercial proposition which adapts itself to quantity production. It must not have to be hand-filed and lapped after entering the assembly room. It must come through so that the assembly is a matter of course and not a matter of expediency. Every carbureter, in other words, must go through alike and not be hand fitted in the assembly process.

City Exits

THE wider use of the automobile is restricted to-day due to several of our largest cities not having adequate exits and further not having adequate streets leading into the main business centers from residential sections. The first situation, that of insufficient exits, is serious. The automobile has largely changed the face of city life. The man of wealth no longer lives where he was 10 years ago. The street he then lived on is to-day a fashionable business street. His residence is now 15, 20 or 30 miles out. The railroad train is at his service but many prefer the automobile. The use of the automobile for such service will increase, but its increase will largely depend on the street facilities. If an hour or more will be needed to get out of the traffic zone as at present in some cities, then the automobile's use in this respect will be unfortunately restricted. What is needed is a wide street, preferably with double roadways and if possible no trolley crossings. This is impossible in some cities but it is not improbable that there will in the next 10 years be elevated roadways for motor travel leading out of our cities. The automobile is of sufficient importance to-day to demand such. In at least six or seven largest cities the elevated motor road is not only a possibility, but very much of a probability. New York, Chicago, Boston and other cities need such to-day. New York is perhaps the easiest city to get out of in America. On the other hand, Boston and Chicago are among the worst. Wider exits are questions that our makers should give attention to, and they are problems that can be handled better and cheaper to-day than 10 years hence.

A. C. Newby

THE withdrawal of A. C. Newby of the National company from the active management of the company is an opportune time for rendering unto Caesar that which is Caesar's, etc. Mr. Newby, while not one of the most conspicuous figures in the automobile field, has been a good representative of that conservative element in the industry which has served so as a stabilizing influence throughout the varying vicissitudes the industry has passed through. He was one of the pioneers in the field, first with the electric vehicle industry and then with the gasoline type of vehicle. Every manufacturer has admired that stalwart spirit of honesty which has been a part of every word and action of Mr. Newby. In the automobile contest field the same spirit had an inspiring influence and Newby was a force for good in automobile racing at a time when such an influence was highly essential.

Germany After the War

By Edward Allen Langdon*

¶ Germany has all told nearly 300,000 automobiles in use to-day.

¶ Germany is now using approximately 160,000 automobiles in the war—one-half on the Western front, one-fifth on Russian, and the remainder in the Near East.

¶ There will be a demand for 300,000 to 500,000 automobiles in Germany after the war closes.

¶ After the war it will be impossible to market automobiles in Germany unless there are good U. S. A. service stations there.

¶ Germany will buy automobiles as a unit and not as individuals after the war.

¶ Germany will offer a good market for U. S. A. accessories and parts.

¶ Adoption of metric system of measurement will gain headway after the war.

GERMANY, while carrying on a warfare admitted to be highly efficient by her very enemies, is already making extensive preparations for the time when peace shall have been restored. This holds good of every department of national life, industry, finance and trade, as well as agriculture and countless illustrations of this activity could be cited. Instead, the following remarks will be limited to the automobile situation, and particularly to those phases thereof which are of necessity of practical interest to American makers and exporters of automobiles.

160,000 Cars Used by Empire

While the official figures are impossible to obtain, thanks to the intense secrecy which surrounds all data of any direct or indirect military importance, the ideas of people inofficially in touch with the situation indicate that the State, *i.e.*, the Empire, is now using close to 160,000 automobiles. One-half of these are in service at the Western front, one-fifth along the Eastern front between Riga and Lemberg and the remainder along the Rumanian and Saloniki fronts.

Besides, there are now in Government service perhaps 50,000 machines far carrying officials and industrial products in Germany herself, and perhaps the same number is employed for private purposes. In all, there are in Germany between 250,000 and 300,000 motor vehicles, and as these are being used up the supply is being replenished; but there is hardly any increase of the total number, because the automobiles on hand are sufficient for German requirements, and also because the raw materials are more urgently needed in the making of munitions, which industry during the last few months has been pushed more energetically than ever before.

The automobiles, the number of which is practically constant, will however not be considered efficient when the war is over and money once more will have to be reckoned with. For this reason it is safe to predict that after the war two-thirds of the automobiles will be replaced by new ones, and it is understood that this will be done on the following plan. The Government will keep the machines commandeered during the war, to be rebuilt and used, either for public works, or to be sold practically at cost to small agricultural individuals or concerns, so as to facilitate farming. On the other hand, the former owners of these cars will receive a Government subsidy of from 45 to 65 per cent toward the purchase of new automobiles built in Germany along standard lines and approved in their specifications by the Imperial Government. Thus, there will be a sure demand in Germany, immediately after the war, for about 200,000 cars.

Horses Are Scarce

But this is not all. Before the war, horses were still extensively used in German cities as well as in the country. They are now very much decimated and it is doubtful whether raising horses will be favored by the Government, and it must be understood that Government control of all economic affairs is a thing growing in Germany by leaps and bounds. Horses have not only proved vastly inferior to motor equipment, but were also somewhat of a disappointment to the German stomach. Very likely all the energy formerly turned toward raising horses will, after the war, be devoted to cattle breeding, and the millions of working horses will have to be replaced somehow.

A 1,000,000-Car Market

If the war ends within a year, assuming developments somewhat similar to the past, Germany will have a population of 60,000,000 people when peace is made. The Empire will then be a highly industrial country and therefore require ample facilities for transporting passengers and merchandise. If the demand will be for one machine to every sixty of the population, the market will call for a million automobiles, of which Germany will be able to supply, with international conditions restored to normal, from 50 to 70 per cent. There still remains a market for from 300,000 to 500,000 automobiles of simple, strong construction, efficient in operation and moderately priced which could be supplied by American exporters.

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*EDITOR'S NOTE—Edward Allen Langdon has for many months been in different parts of Europe studying automobile conditions in those countries. Mr. Langdon is a critical student of conditions. He is making a comprehensive study of trade and all his utterances savor of conservatism.

Points to Be Considered

Following are the points to be considered by German buyers:

1—*Fuel Economy.*—Efficient operation will be as necessary after the war as it is now. Taxation will be high, there will probably be a general and fairly high tariff, and every cent will count.

2—*Durability.*—Automobiles will be driven by careful, well-taught drivers, of whom there are now hundreds of thousands, thanks to the army training. Nevertheless, each automobile will always be worked to its full capacity, and wherever seven-passenger touring cars or five-ton trucks are bought, they will be expected and called upon to prove their true character every minute of a working day.

3—*Diversity of Fuel.*—It is quite likely that industrial alcohol and benzol will be cheaper than gasoline after the war, as they were already before its outbreak. Other things being equal, motors adapted for such fuels will have a point in their favor over ordinary gasoline motors.

4—*Agricultural Field.*—Many thousand of cars will be required which are of the passenger type, lightly built, of 18 to 24 hp. and adaptable to driving agricultural implements, such as ploughs, hoes, spreaders, etc. These machines will have to be very simple and very strong in construction and it will be necessary to not only give clear demonstrations of their ability to do the work, but to submit doubtless proof of past performances.

5—*Passenger Cars.*—They should be completely equipped, with self starters and electric lighting, high-tension ignition and substantial tires.

6—*Trucks.*—Simplicity of design and strength will be the chief features looked for, but starting and other equipment will count, as many machines will be driven by women who have now assumed a definite position in Germany's industrial life. Electric trucks will find a specially good field in the industrial cities.

Service Absolutely Necessary

7—*Service.*—It will be almost impossible to market an automobile in Germany, unless there is a service station including a complete stock of repair parts within the Empire.

It is now almost certain that Germany will buy abroad, and perhaps also from importers in the Empire, as one corporation, with the double advantage of eliminating competition among bidders and also of enormously reducing overhead expense. This does not mean, however, that trading with Germany will not be profitable; only, it will be necessary for American business men to meet efficiency with efficiency. In other words, if Germany's automobile industry and the users of automobiles in Germany will face the world market as a solid financial unit, Americans will have to adopt the same policy, at least in dealing with Germany.

Co-operation Favored

The German Empire does not know the reactionary unscientific legislation against progressive concentration in business and rather favors than hampers it. Therefore, American automobile dealers in Germany can quite well work together, conducting a permanent automobile exhibit in Berlin, Frankfort-on-Main, Leipzig and one or two more of the most important centers, using corporate advertising and letting their salesmen work hand in hand, distributing the products of all the companies to best advantage.

As has been said, taxation and duty will be high in Germany after the war, and only very efficient management will be able to successfully combat these handicaps. Duty on chassis and cars will most likely be higher than on automobile parts, and here the opportunity for the parts manufacturer begins. Motors, axles, steering and transmission gears, which America can easily supply, and which would come up to Germany's demand both in regard to quality and quantity, should find a ready and highly profitable market in the German Empire.

The same holds true of certain classes of equipment, especially electric starting and lighting sets. There is less opportunity for makers of speedometers and particularly delicate instruments, as the class of labor required for such manufactures is specially cheap in Germany.

Look to U. S. A. Industry

To some people consideration of all these points may seem premature, but if Germany who is at war considers them of sufficient importance to give them at least initial attention, American manufacturers ought not to overlook their possibilities. In fact, when the magnitude of this field is considered and that the business to be done is bound to amount to hundreds of millions, it is not surprising that Germans engaged in the automobile business are expecting the American industry to take well-organized steps toward capturing the lion's share of this business.

If the U. S. A. automobile industry, as a body, should approach the German government, it would in all likelihood succeed in obtaining for the buyers of U. S. A. cars, if not the same, then at least part of the subsidy extended to purchasers of native cars conforming with Government specifications. Perhaps, if the Government should feel unwilling to take such a course, an agreement could be obtained for a short term, say 2 to 5 years.

Getting a Foothold

Even if the market for American cars should be made more difficult after such an introductory period, many users would thereafter stick to the American product if it gave them satisfaction. This point, of getting a foothold in Germany immediately after the war, is the more important, as interests across the Channel will hardly be sentimental enough to sidestep profitable business with Germany, and as the very machine tools now making munitions against the Empire will then be used for making other, and marketable, products.

Before the war, Germany was England's best customer; after the war, if she can do so without serious loss, she will prefer to buy from others than her former enemies wherever possible, without declaring any distinct trade war.

Subsidies Are Possible

This immediately brings to the light another point, which is only of indirect bearing on the automobile situation, namely, that subsidies for cars built along lines approved by the Government will, as has been mentioned, be continued vigorously. This, however, indicates nothing more or less than the preparation for a renewal of the conflict now going on. As a matter of fact, well-informed Germans even to-day admit that, while they are perfectly confident as to the result of the war, they do not expect it to bring a definite decision; but they do expect that when the struggle is renewed they will have more friends among the nations than before the present war. From this viewpoint, Germany will very likely be ready to make greater advances in its trade relations to America than in the past, and this will be specially true where products of military value, such as automobiles, are concerned.

Another point to be remembered in dealing with Germany is that unless the war will continue to the utter exhaustion of Europe, its end may find Germany dominant in the Near

East, directing the affairs, in a larger sense, of not only Austria-Hungary and Bulgaria, but of Turkey, the Balkans and very likely Italy, with a strong influence in Scandinavia thrown in. Therefore the relations of any power with Germany will materially weigh in determining its dealings with the countries belonging to the German sphere of influence, which sphere during the past 18 months has been constantly increased. From this viewpoint, too, German business will pay.

Present Conditions Temporary

There are quite a number of materials formerly imported into Germany but now not available, due to the blockade. For most if not all of these serviceable substitutes have been found and the Germans are as a matter of course very enthusiastic over all these discoveries. There is no doubt, however, that a great many of these substitutes though they made fine makeshifts will not prove commercial when peace returns; although it may be that with some additional experimenting and study they *may* develop into profitable propositions. The fact that an article found extensive use during the war has almost nothing to do with the possibility of producing it profitably, or even, for that matter, without a loss.

It must be remembered that the consideration for profit, at least from the State's point of view, is being completely thrown to the winds for the time of the war's duration. The Government pays liberally for everything, money circulates at a very lively rate and everybody makes plenty of it. But, as remarked, these conditions will almost instantaneously cease with the war. Hence, a great many effective substitutes unless profitable in competition with the original articles will disappear.

Rubber Most Important

The most important of these products, so far as the automobile industry is concerned, is rubber. The Germans claim that they are now using a lot of synthetic rubber, and from the fact that automobiles are equipped with the necessary tires, it would seem that their statement is correct. It is not so certain, however, that the production of the synthetic product will be able to continue after the war, in competition with natural rubber; and here, too, there may yet be a very great field for American manufacturers. The competition in the normal European market, so far as tires are concerned, includes a considerable supply of English and French made goods; for which reason the above remarks, referring to the need of Americans being awake to the very earliest trading opportunities offered by Germany after the end of the war, hold true in the tire field also.

Parts and Accessories in Demand

When the chance and probability of hundreds of thousands of American cars being sold in Germany, is considered, it follows that reserve parts and accessories, from springs to spark plugs, will find a ready market here, too, as long as these American cars are used and continue to come in. Accessory and parts makers and tire exporters, for that matter, also will do well to consider the same principles of economy and efficiency in German exporting as were laid down in the foregoing remarks for makers of automobiles.

Poland May Develop

The European war, reducing Europe to two spheres of interest and influence, as it is bound to, will also bring into prominence once more the world-wide adoption of the metric system. There is a considerable probability, according to the opinion not only of German but of neutral engineers as well, that England will very soon and completely adopt the general use of the decimal system for weights and measures. This will be one of the minor effects of the war, but will be of considerable bearing upon international trade in products made according to mathematically exact measurements.

Although officially independent of Germany, the new Kingdom of Poland, one-quarter as great as Germany and populated by almost 15,000,000 people, will present a noteworthy market resembling in many respects that of the Empire itself. Poland is a rich grain country, although the population up to now has been anything but prosperous, and very likely will now be developed not only to greater agricultural efficiency, but also into an industrial section of quite some importance. The country is level and the roads not as bad as 2 years ago. The Germans are already doing a good deal in modernizing conditions and soon after the war Poland ought to offer a good market.

In a way, this holds true of the Balkan States, too, which have once more been roused to more modern ideas and methods by the war. No matter what the political distribution after the war, the territories now known as Servia, Bulgaria, Rumania and Greece will be in the market for all sorts of modern appliances, including automobiles and kindred products.

Must Begin Now

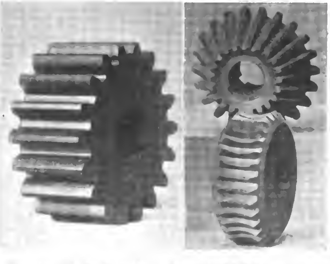
As has been stated in the introductory paragraph, only the most striking features of the situation now developing in Germany are given attention here, and a great deal will be left to the ingenuity of American business men regarding the best way of getting the business to be obtained in the Empire and its Confederate States. Too much stress, however, cannot be laid on the point that conditions should be studied and plans outlined—as far as possible—now, without waiting for the end of the war. Capable people should be despatched to the Continent to look matters over and so far as can be done now, prepare for commercial relations to be taken up as soon as normal conditions are restored again. The earlier this is done, the more favorable will be the conditions American manufacturers will be able to obtain in dealing with the authorities handling these matters.

After the War

To sum it all up in so many words:

After the war, more than ever before, the devil is bound to take the hindmost; and the hindmost will be everybody who will fail to realize very early that the whole fabric of European economic life is being completely rewarped by the war.

Westinghouse Noiseless Bakelite Gears



Examples of gears made by the Westinghouse Electric & Mfg. Co. from Bakelite-Micarta-D. This material is claimed to be almost noiseless in operation and to be so strong that it can be used without metallic inserts for timing gears. It machines easily, takes a high polish and is not affected by oil

Four Is Ultimate Engine

Sixes, Eights and Twelves Have Special Uses but Four Is Automobile Engine of Greatest Value—Production Restricts Development

By A. P. Brush*

ISN'T the four-cylinder engine coming back? Will the four-cylinder engine ever come back? As a matter of fact, the four-cylinder engine isn't coming back and never will come back. Such a thing is impossible, for the very simple reason that it has never gone out.

Considered solely from the standpoint of numbers, the four-cylinder engine is, and has been for the last 10 years, the standard prime mover for self-propelled road vehicles and, in my judgment, will continue to be so long as the four-cycle internal-combustion engine holds its place as the most satisfactory prime mover for mobile use. Other engines of the four-cycle internal-combustion type, such as the six-, the eight- and the twelve-cylinder forms, are more or less special engines built for the purpose of securing results outside the range and capacity of the four.

Naturally the question will suggest itself, if the four-cylinder engine is susceptible of development and improvement, and if it is even numerically the most popular engine and has the greatest amount of capital invested in its production, is it not reasonable to suppose that its development has been carried further than that of any other mobile prime mover?

Multi-Cylinder Development

It is my opinion that the six-, the eight- and the twelve-cylinder have all been developed more nearly to their ultimate possibilities than has the four-cylinder engine, and it is also my opinion that the greatest obstruction to the development of the four-cylinder toward its ultimate possibilities has been and is its very popularity. *Volume of production makes for efficiency of production and stagnation of development.*

The production engineer has carried his work nearer to the ultimate with respect to the four-cylinder than with respect to the six, the eight or the twelve, but to secure this result the production engineer has been an obstructionist as regards the development engineer. With his face set firmly in the direction of efficiency in production, he has been, with equal fixedness, opposed to change, because change is the arch enemy of production efficiency.

Progress in design, so far as the large-quantity manufacturer of four-cylinder-engine cars is concerned, may be said to originate only in the minds of the sales department, finding its expression in their effusions, to the end that it may exist as an hallucination in the mind of the ultimate consumer.

Production vs. Engineering Progress

While the foregoing may sound like an arraignment of the large manufacturers of four-cylinder-engined cars, I for one do not consider it as such. The efficiency of production that has been achieved was only possible because of this artificial stagnation in engineering progress. My only purpose in bringing these conditions as regards the four-cylinder engine to your attention is that these conditions are, to my mind, justification for the statement that relatively more progress can be made in the design of the four-cylinder engine than in any of the other types.

A Commercial Angle

There is another very real obstruction to the development of the four-cylinder engine. It has come to be accepted as the engine for the extremely low-priced automobile. It is, of course, possible that these Kresges and Woolworths of the automobile industry are producing the only marketable type of light-weight car of limited passenger capacity. That is a commercial rather than an engineering question and, technically at least, outside our consideration at this time. For use in the so-called pleasure type of automobile the four-cylinder engine is pre-eminently the engine to be used in light-weight cars whose ultimate owners are their own chauffeurs and mechanics. Right here I want to venture the opinion that this class of user is entitled to, and a considerable proportion are willing to pay a reasonable addition for, better car performance and higher comfort value combined with the same or greater simplicity and compactness of mechanism.

Let us consider first the question of performance. Four of the leading manufacturers of four-cylinder cars claim for their engines maximum horsepower per cubic inch of piston displacement ranging from 0.142 to 0.206, with total piston displacements ranging from 170 cu. in. to 213 cu. in., and maximum total horsepowers ranging from 25 to 35.

During the past year a four-cylinder engine has been designed, tested, and its production in a light-weight car has been arranged for. The cylinder dimensions are 3¼ in. by 4½ in., giving a piston displacement of just under 150 cu. in. Its maximum power, as determined by exhaustive dynamometer tests, is just over 44, giving a horsepower per cubic inch value of 0.29. Comparing this with the best four-cylinder engines previously referred to, you will find an increase of over 40 per cent in power output per cubic inch of piston displacement and an increase of over 25 per cent in total horsepower available.

Performance the Question

Comparing maximum horsepower output does not tell the whole story. Good performance in an automobile means, in the engine, a high power output throughout a wide percentage range of speed. In this respect this little engine probably surpasses its popular predecessors to at least an equal degree. Owing to the absence of published power curves I cannot make a direct comparison in this respect. I can only tell you that it excelled the maximum power output per cubic inch of its predecessors throughout a range of over 2000 r.p.m.; that is, it developed over 0.2 h.p. per cubic inch from 400 r.p.m. to 2600 r.p.m. Because of its smaller cylinder diameter, and, further, because of the fact that it is of the two-bearing-crankshaft type, this engine occupies much less room in the car than any of the other engines used for comparison. This means, of course, either more passenger room and comfort for a given wheelbase or the same passenger room and comfort with less wheelbase. These comparisons,

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*Paper read before Buffalo Engineering Society, Dec. 13.

I think, clearly demonstrate the possibility of increased performance values in the light-weight four-cylinder car.

Now, let us see what are the results in comfort value. The objectionable characteristics of a four-cylinder engine are vibration at high speed, due to the weight of the pistons and the angularity of the connecting-rods, and another class of vibration which may be described as torque vibration, due to the relatively heavy and infrequent torque impulses at very low speeds. Obviously these smaller cylinder dimensions mean a reduction in piston weight, with a consequent reduction in vibration tendencies at high speeds, and because of its greater speed range it is obviously possible and advisable to use a lower rear-axle gear ratio, which means, of course, greater frequency of impulse and therefore less torque vibrations at low speeds. This marked increase in performance and comfort value has been secured with no increase in the complication of the mechanism which the owner-user must understand and care for, and production efficiency is equal, with very little if any increase in engine cost.

Valves Are Adequate

To avoid making this paper too long I shall give you only the briefest possible résumé of the essential details which were the means employed to secure the results outlined. The little engine is of the overhead-valve type, and, by the omission of valve cages and some other minor details of arrangement, valves of adequate size were used. Having secured valves of adequate capacity, the next problem was to secure a carbureter and manifolding arrangement which would give somewhere near maximum power at high speed and not destroy the engine performance at low speed. This result was secured by means of what may be described as a low-velocity down-draft dry manifold.

The Lubrication Problem

The next difficulty encountered was the failure of conventional lubricating systems to function properly in an engine of large power output and extreme speed and power range. This difficulty was overcome by using an oiling system which automatically controls the temperature of the crankshaft and its bearings, which gives a positive delivery of oil to the crankshaft and crankpin bearings, and which is interconnected to the engine throttle so as to vary the oil pressure with variations in power output.

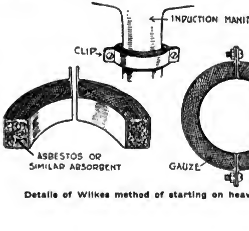
To secure compactness the center bearing of the crankshaft was omitted, distortion of the crankshaft at high speed being prevented by fully counterbalancing the shaft and also by the use of an extremely rigid shaft, the crankpin diameters being 2¼ in., with crank cheeks of equal rigidity. I have given you this brief outline of the results obtained in this engine and the essentials of design by which these results were obtained, not as an example of ultimate possibilities but simply as one example showing a substantial advance toward that ultimate.

Warming a Manifold for Using Heavy Fuel

A SIMPLE method for warming up an induction manifold so as to enable an engine to be started on kerosene or something nearly as heavy without the use of gasoline, is described in a recent issue of *Motor Traction*, London, as the Wilkes method.

"The apparatus (which has been patented), as will be seen from the illustration, is an exceedingly simple and valuable asset. The small methylated alcohol stoves which are used in many households for the emergency warming of a small saucepan or kettle are well known, and it is this principle which has been adopted for warming up the induction pipe prior to starting.

"The arrangement consists of shallow metal circular or annular cups attached by suitable clips to the induction pipe immediately above the jet. The base of these circular cups is filled with asbestos wool or simliar material, which is covered on the upper surface with fine wire gauze. Into these cups is poured the substitute or other suitable fuel, which impregnates the asbestos wool; this is ignited by means of a match or otherwise, producing a flame which burns for some time around the induction pipe, warming the latter sufficiently to obviate condensation, assisting the vaporizing of the liquid from the jet, and thereby rendering starting quite easy. In practice the time necessary on a standard Zenith carbureter for starting from dead cold has, we learn, been proved to be only 3 min.



Details of Wilkes method of starting on heavy fuel

"For purposes of running when once the engine is started, it is desirable to fit an exhaust-heated pipe immediately over the carbureter jet, so that vaporization of the fuel is assisted, such additional exhaust pipe being included in the patent specification.

"We understand the apparatus has been thoroughly tried and has proved most satisfactory in practice. When once the engine has been warmed up it will usually restart within a reasonable period by use of the handle only in the usual way."

Committees on Welfare Work at Reo Plant

THE Reo Motor Car Co., Lansing, Mich., is devoting many efforts toward welfare work for employees. A number of interesting and valuable methods devised to aid workers have been installed. The welfare work branches into a number of different departments and is done under supervision of department heads or by committees of men and foremen.

The safety committee comprises a chairman who gives his entire time to this work, and seven members each representing a division of the factory. Through this committee a constant oversight is maintained on the machines and safety appliances and the practices of the employees using them. Financial aid is given men, first through a fair wage, the minimum at the factory being 30 cents an hour. And a man in financial trouble receives additional help if the case is worthy by means of temporary loans or adjustment with the creditors.

A real estate commitee advises employees in the purchase of homes or the sale of real estate and is a great aid to foreigners unacquainted with conditions.

The company also maintains a first aid and hospital service, an industrial hall seating 1600, four bowling alleys, a library and dining rooms. They are at present erecting a clubhouse for employees which will probably be completed in December.

Pressure Lubrication Advantages

Theory of High Pressure Oil Feeding Borne Out by Experiment —Difficulty in Applying Very High Pressures to Automobile Engines—Importance of Cooling Effect of Oil on Bearings

By A. Ludlow Clayden

THE reason that splash lubrication is still more used than the pressure system is not entirely because the former is cheaper to manufacture. In an automobile engine the problem of keeping oil out of the cylinders has been more absorbing than the other problem of insuring enough for the bearings. With splash oiling it is easier to prevent over-lubrication than with a pressure system, and splash oiling will, when well designed, give the bearings a supply sufficient to insure a reasonable life for the bushings.

On the other hand, bearings fed with oil under high pressure will outlast similar bearings fed by splash; they *can* be made almost everlasting. Engines have been built in which the crankshaft and connecting-rod bearings were able to keep their original tightness for 50,000 car miles. Give such an engine enough clean oil at regular intervals and you can almost forget that it has any bearings in it. Of course engine bearings in any good motor require renewal only at long intervals, so that they are not very costly to keep in repair, but everything that can be done to lengthen the period during which a car will run without mechanical attention is worth doing. Rear axles used to need tearing down and inspecting every 5000 miles or so. Now they will operate for years without any adjustment. It is but seldom now that a gear in the transmission has to be replaced, and ball and roller bearings have reached a pitch of perfection that enables them to outlast the gears. Even clutch facings now last an immense time, and the only part of the electrical equipment that needs much attention is the battery.

The day is in sight when an automobile will run for five years with no more attention than supply of lubricant and perhaps an annual wash out with kerosene before filling up with fresh oil. This is the reason why it is worth while to try to improve upon engine lubrication, which is already quite reasonably good.

From the viewpoint of the bearings in an engine we should design the lubrication without regard to the cylinders and, having cared for the bearings properly, we can then devise means for preventing cylinder flooding.

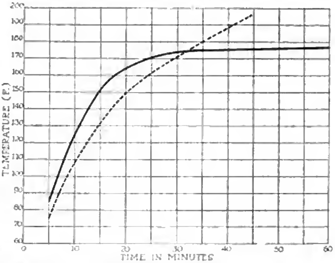
Theory of Pressure Oiling

The theory of lubrication has made a study for engineers of all nations for many years, and there are points which are still undecided. There are, however, a few simple rules which are accepted as fundamental.

1. Frictional resistance of a bearing decreases as the thickness of the oil film increases.
2. The loading for a given speed must not exceed a certain limit at which the oil film breaks down.
3. This limit is raised by making the bearing longer, because this increases the cooling effect of the oil.
4. The oil temperature varies throughout the bearing, being greatest where the oil film is thinnest.
5. Oil grooves placed wrongly may destroy the continuity of the film and so actually prevent proper lubrication whatever the oil supply.
6. A bearing with a reciprocating load is easier to lubricate than one with a constant load, as the relief of loading allows the entrance of oil (if it were not for this, splash lubrication for automobile engines would be impossible).

The value of pressure lubrication is mainly explained by item 1. We can regard the shaft and the bushing as being separated by a thin layer of jelly. When the load comes on, this jelly will be compressed on one side and allowed to expand on the other. Now, with a lubricated bearing the shaft and bushing ought not to touch. The frictional resistance is due to the force required to "shear" the oil film. The power required to do this decreases as the film grows thicker. Returning to the jelly illustration, it is obvious that the amount which the load would move the shaft relative to the bushing must depend upon the strength of the jelly. If the jelly is viscous it will resist displacement better than if it is thin. Actually, in a bearing, the effect of shearing the oil film is to heat the oil, thereby reducing its viscosity. If we can remove the oil as fast as it is heated, replacing the hot oil with cold lubricant, the viscosity can be maintained, and the shaft kept more nearly concentric with the bushing.

The function of pressure is to compel the continuous change of oil in the bearing. The cold oil being forced in drives the hot oil before it, giving it a chance to recover its viscosity before it returns to the bearing again. It is also beneficial in another way. Regarding the bearing as containing oil that can only escape at the ends, we see that the outlet consists of two narrow rings equivalent to a slit, twice the circumference of the bearing in length, and of a width equal to the clearance between the shaft and the bushing. No liquid will flow through a slit or other orifice in direct proportion to the pressure behind it, but in a proportion that decreases as the pressure rises. If a certain quantity flows



Effect of circumferential groove in bushing in reducing temperature. In this test the most efficient cooling, as shown by the full line curve, was obtained with a simple central groove to feed oil under the 40 lb. pressure. The other curve shows the greater rise of temperature when oil was fed to two longitudinal grooves close together and connected out when there is a 5-lb. pressure behind, then less than double that amount will escape when the pressure is 10 lb. When the pressure on the oil supply is small the bearing is not kept completely full. With splash oiling, for example, the oil enters by suction of a sort. The oil in the bearing is squeezed out by the load on the shaft, and a partial vacuum is left in its place. This enables the atmospheric pressure on adjacent oil to drive it into the bearing, so displacing the vacuum.

Now with pressure-fed oil the bearing is kept permanently full, which means that the oil film is always as thick as possible; there are no variations in film thickness except those due to the oscillations of the load. Experiments made on bearings have shown that the friction decreased steadily as the oil pressure increased. In one particular experiment made on a steam engine giving 120 hp. at 450 r.p.m. it was proved that the friction horsepower was 3.33 with splash-fed oil and that this dropped to 2.13 with an oil pressure of 30 lb. per square inch, a steady fall in friction being noticed as the oil pressure was raised in small stages from nothing up to 30 lb. This is just one from a long series of similar experiments all showing the same thing, namely, that the power absorbed by friction in a bearing decreases as the oil pressure increases.

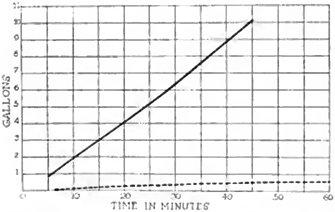
Precisely why this is remains a matter for argument, but some idea of the effect of high pressure oil may be obtained from the following analogy, which is not strictly a parallel case, though it serves to show the idea.

Suppose we regard the oil film round the shaft as a pneumatic tire and imagine that a series of rapidly varying loads are put on the shaft; then, obviously, the greater the pressure in the tire the less will the shaft move as the loads vary. If the tire is soft a big load may absolutely flatten it, driving out all air at one place; if the tire is hard this will not happen.

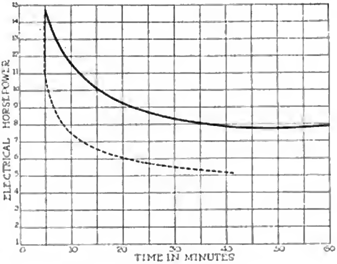
So with an oil film; one under high pressure will keep the shaft away from the bush while one under no pressure may be broken down by a sudden heavy load. An oil film in a bearing may be likened to the tire mentioned above, but with a constant leak in it, so that air is escaping all the time and has to be replaced.

Pumping Action of Bearing

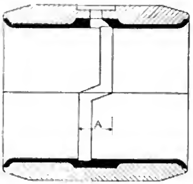
Luckily, a rotating shaft in a bushing is itself an oil pump. If it were not, lubrication by any other method than forced oil would be impossible. To use another rough analogy, suppose the shaft to have a series of blades on it and to be floating central with the bushing with the tips of the blades just clearing the bushing. Now put a load on the shaft so as to displace it relative to the bush, and we see that the space between the tip of the blade and the bush will be greatest on the side of no load and least on the side where the bush is supporting the shaft. Now imagine the shaft to be turning and the oil clinging to the surface of the bush. A blade descending toward the place of least resistance will be carrying a certain quantity of oil before it, and as the clearance decreases some of this oil has to escape. But the nearer the blade gets to the bottom the narrower will be the clearance through which such escape can occur; thus the pressure in the oil at the point of smallest clearance will be a maximum. In actual fact the point of smallest clearance is *not* directly opposite the point of loading, except when the shaft is not turning. The shaft carries the point of maximum oil pressure a little past the point opposite to the load, the exact location depending upon the speed of rotation.



These curves show the relative quantities of oil passed by the two systems of grooving the bushings. The bearings are the same as those used for the test of increase of temperature with time of running, showing that the lower temperature is due to the larger amount passed with the central, circumferential groove



Above — Curves from same pair of bearings showing the electrical horsepower taken to drive the shaft under load. After the state of equilibrium had been reached the bearing with the more copious lubrication required more power to drive it, but the bearing with the restricted supply was too hot to be safe to run further after 40 min.



Right—Groove for obtaining the best flow of oil in a bearing supplied with oil under pressure

There are several factors, the size of the shaft and length of bearing, the load, the speed of revolution and the viscosity of the oil. For any particular case, all things being settled except the load, we can find a maximum load which will just be supported without breaking through the oil film at the point of smallest clearance. Taking the same conditions but putting the oil *supply* under pressure, we gain an effect equivalent to an increase in the strength of the oil film, allowing a higher load to be carried before breakdown in the film takes place.

There have been many learned works on lubrication and many long series of experiments, but these all serve only to give an indication of what may be going on in an automobile engine bearing. Nearly all the experiments have been made with large bearings running under constant loads, and the load in an automobile engine bearing varies constantly. Variations in cylinder pressure, coupled with the inertia effects of the reciprocating parts, cause perpetual variations in the oil film conditions. It is thought by most investigators that this is of great assistance in maintaining the film. Suppose a load placed suddenly on the shaft, as by the explosion, it must take some fraction of a second to squeeze out the oil. By the end of this period the load is smaller or has changed its direction, thus offering relief to the oil film an instant before its fracture occurs, and the same thing is repeated throughout the whole cycle. Were it not for this, lubrication of a piston pin by splash would be utterly impossible. Here again the effect of having the oil under pressure can be seen, for it takes longer to squeeze out compressed oil than oil under little or no inherent pressure.

Another thing that is but little understood is the cooling effect of oil and its influence upon friction and the wear of bearings. In the sort of steadily loaded bearing with which experiments have been made there appears to be a definite oil temperature at which friction is lowest, but in these cases the only heat that reaches the bearing is the heat produced by friction. This is not true of an automobile engine, for this is kept hot and the 180 deg. or so in the water jacket is enough to maintain the crankshaft bearings at a fairly high temperature without the heat of friction.

Oil Cooled Bearings

Working on the assumption that lubrication will be assisted if the crankshaft is provided with more than ordinary methods for getting rid of its heat, A. P. Brush has devised his ingenious system of lubrication which uses the crankshaft itself as the main oil distributing channel. In this layout oil is pumped to an end bearing of the crank and led right through to the other end, small side holes giving the supply to the various other bearings. The idea is to pass through the crankshaft a much larger volume of oil than could be passed through the bearings.

No doubt in a splash system of oiling the oil which covers every portion of the inside of the crankcase carries off a good deal of heat as it drains back to the sump, thus using for cooling purposes more oil than passes the bearings, but there is one thing that must not be overlooked in considering the use of the oil as a cooling medium as well as for lubrication, and this is the ability of the oil in the sump to part with its heat to the atmosphere. The sum total in effect of supplying a bearing with a small quantity of *cold* oil might easily be the same as that of giving it an equivalent quantity of warm oil, using more warm oil to help cool it in other ways. If we assume that the oil, by some means, has to carry away so much heat from the bearings, we must provide the sump with means for transferring just that same quantity to the atmosphere.

Oil Radiators

In this connection it may be remarked that C. Y. Knight is reported to have wished, when designing the first Daimler engine, to pump the oil through external radiating tubes; possibly a few tubes in the water radiator could have been isolated for this purpose, but the Daimler Co. objected for fear it might be said that this was *necessary* with the Knight engine. In some racing cars oil radiators have been used most successfully, and in the short races at Brooklands a very usual trick was to have a big hand pump full of cold oil which could be shot into the crankcase about 150 yards from the finish, the result being a sensational jump in speed lasting just long enough to get over the line. This was in the early days and did not apply to modern machines with lubrication systems suitable for continued high speed work.

Another detail of lubrication which has had practically no attention is the grooving of bearings for obtaining the best distribution of oil. The few experiments made and reported go to show that most oil grooves do more harm than good. The reason for this is that the oil film is broken by the groove. Why this is can be realized when we remember that a groove connects different parts of a bearing and that the oil film pressures are different at different places. If we link two spots together by a groove we cannot easily maintain different pressures at the two ends, since the groove acts like a passage external to the bearing.

In a splash system the oil groove ought to run lengthwise of the bearing so as to carry oil nearly the full length, and the groove should be located at the point of minimum oil pressure. Here it will not interfere with lubrication, since the pressure will be the same for the whole length. Diagonal grooves are disturbing to the equilibrium of the oil. But there is a difficulty here, this being that the point of minimum pressure on the circumference of the bearing is changing every instant as the direction of load changes. This means that a number of grooves linked together may be better than a single groove, despite their drawback.

Need Only Central Groove

With forced lubrication, however, grooves lengthwise of the bearing are seldom necessary, since automobile engine bearings are short for their diameter. Experiments made by R. K. Morcom, the head of the first manufacturing firm in Europe to build high speed steam engines in quantities, showed that the power absorbed by a bearing was reduced as the quantity of oil passing was increased. This probably is due to two things, to the cooling effect of the extra oil and to the fact that a big flow forced through means that the oil film is thicker and the danger of its breakdown less. The result of Morcom's researches showed that the best form of oil groove where lubrication is under pressure is a shallow groove right round the middle of the bushing with no longitudinal grooves. The theory of the effectiveness of this is that it forms a reservoir of oil under pressure, and thus insures a direct supply at whatever point on the circumference the minimum pressure due to the load may happen to be least at any instant. The plain circular groove, however, has one disadvantage, this being that it will, after a time, provoke the growth of a ring on the shaft. To overcome this Morcom staggered the upper and lower halves of the groove, this giving essentially the same effect as the plain groove so far as lubrication is concerned, but removing any danger of uneven wear on the shaft.

The results of Morcom's work were summed up in a paper read in England as long ago as 1910, and most of the curves shown here are taken from that paper. It is rather remarkable that nothing of the same character seems to have appeared since, for Morcom admitted that his research could be carried much further. For example, he stated that the flywheel end bearing in an automobile engine might need a lengthwise groove as well as the central ring, in order to permit enough oil to be passed through, but the exact location of such an additional groove and its proportional dimensions have, so far as the present writer is aware, never been studied completely. There is no data available on small bearings under alternating load with different groove proportions and fed with oil under different pressures, and there is an opportunity here for some engineer with a good laboratory to do some most valuable work.

Cylinder Oiling Separate Problem

Automobile engine lubrication has been complicated terribly as a problem by the need for using the same oiling system for the bearings and the cylinders. The effect of the smoke trouble and of carbonization has been to cause lubrication systems to be designed for the cylinders rather than for the bearings, and this has perhaps been a factor in restraining proper examination of the subject *from the bearing viewpoint.*

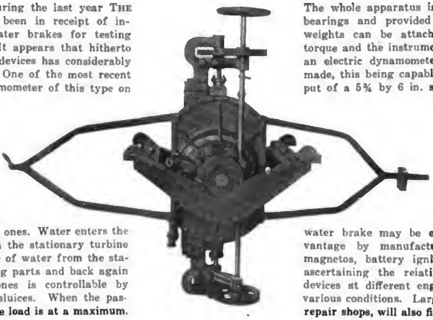
Ideally we should design our lubrication for the bearings and care for the cylinders afterwards, but the presence of too much oil in the cylinders seems so very difficult to prevent that engineers have perforce given most of their attention to what ought to be a subsidiary problem. Thus any investigations that may be made ought to be independent of the cylinders, for what we want to know is the facts regarding bearing lubrication. Once having these we can proceed to devise means for caring for the pistons.

In discussion of an S. A. E. paper on a quite different subject, K. W. Zimmerschied questioned whether we might not some day come to thermostatic control of oil temperature. That we shall soon have an almost constant water temperature both winter and summer seems more than probable, so having thus removed one variable, it is not unlikely that Mr. Zimmerschied's suggestion for removing another may be followed out. If this is found possible in a commercial way it should be easy to discover by proper tests what pressure variations are desirable for the oil. Pressure, temperature and load are all connected in some way. To get the lowest bearing friction they must all be proportioned.

If the subject of bearing lubrication, here briefly outlined, waits the attention of a scientific investigation, there are other factors which are purely mechanical and do not require the same sort of laboratory study. One is the relation between size of pump and of oil leads to provide a desired flow at a desired pressure, and the other is means for keeping oil away from the cylinders. Since these matters are separate altogether from the theory of bearing lubrication, they are better considered as an entirely different subject, and it is the writer's intention to attack this phase in a subsequent article.

Herschell-Spillman Co. Manufactures Water Brake

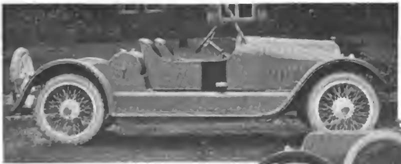
Brings Out Device for Testing Automobile Engines



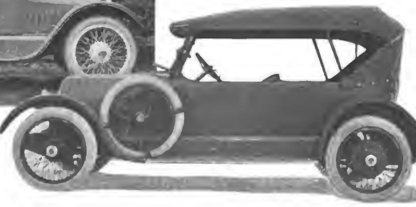
SEVERAL times during the last year THE AUTOMOBILE has been in receipt of inquiries concerning water brakes for testing automobile engines. It appears that hitherto the demand for such devices has considerably exceeded the supply. One of the most recent firms to place a dynamometer of this type on the market is the Herschell-Spillman Co., North Tonawanda, N. Y., maker of the Herschell-Spillman engines. The instrument consists of a double rotating turbine with two stationary members and two revolving ones. Water enters the brake through holes in the stationary turbine blades and the passage of water from the stationary to the revolving parts and back again into the stationary ones is controllable by opening and shutting sluices. When the passages are wide open the load is at a maximum. The whole apparatus is mounted upon roller bearings and provided with arms to which weights can be attached in measuring the torque and the instrument is used exactly like an electric dynamometer. One size is being made, this being capable of handling the output of a 5¾ by 6 in. six-cylinder engine. It weighs 350 lb. and measures 8 ft., 2 in. from tip to tip of the two arms, as shown in the accampanying illustration.

Besides being useful for testing automobile engines, the Herschell - Spillman water brake may be employed to great advantage by manufacturers of carbureters, magnetos, battery ignition systems, etc., in ascertaining the relative efficiency of their devices at different engine speeds and under various conditions. Large service stations and repair shops, will also find it useful.

Two New Models on Daniels Eight Chassis



Above is the new speedster model mounted on the eight-cylinder Daniels chassis. The slanting windshield, sloping rear deck and spare tire carried at the rear aid in creating an impression of racy lines. Note step beside buffer

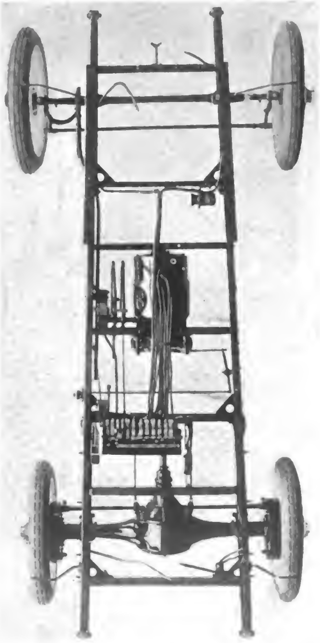


Below is the four-passenger Daniels eight-cylinder model which has an aisle between the front seats. Note the unusual lines of the top which has a rounded effect at the rear, and also the large overhang of the fenders

Standardization in Detroit Electric

Car Lightened, Tire Size Reduced, and Spring Suspension is Changed to Semi-Elliptic

Model 68 Detroit Electric brougham selling for $1,775



Plan view of the chassis illustrating the motor mounting, controller set and layout of wiring

STANDARDIZATION and all that quantity production infers have resulted in a reduction of $1,100 in 2 years in the price of Detroit Electrics made by the Anderson Electric Car Co., Detroit, Mich. The cuts last year were from $600 to $725 below the former cost, and this year $500 additional has been taken off the selling price without lowering the quality of the product, but simply by applying the rules of scientific manufacture on a quantity basis.

The reduction in price has been made possible by increasing largely the supply of up-to-date automatic and semi-automatic machinery, by using the chain method of production and by standardizing the product through the elimination of a wide variety of options in color, upholstery, finish, etc. The only changes in the specifications outside of the fewer options are a reduction in tire size from 34 by 4½ to 33 by 4½, a change in the spring suspension from elliptic rear to semi-elliptic all around and a reduction in the size of brakes and some of the dimensions due to the elimination of considerable overweight in the construction of the body. In spite of the great reduction in price this year, from $2,275 to $1,775, there was no apparent difference in the exterior of the cars with the exception that the side lamps are eliminated on the new model and the running lights incorporated in the head lamps.

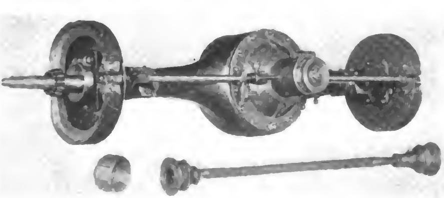
Two Chassis Models

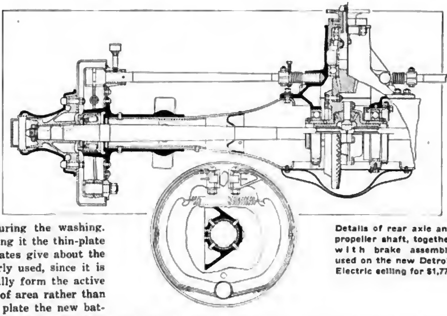
The more expensive chassis is continued, thereby giving the Anderson company two chassis models in place of one last year. The leader, however, will be the new model which is known as 68 and which is the product that is being put out on a quantity basis.

One of the important changes which has lowered the price of the car and has made it lighter, giving a considerable advantage in mileage rating, is the use of leather roof in place of the sheet aluminum. Weight has also been saved by the use of Hotchkiss drive, in the semi-elliptic spring and in the smaller wheels which have, however, the same section diameter of tire. The difference of weight is reflected in the smaller battery which is a forty-two-cell, thirteen-plate in place of a forty-two-cell, fifteen-plate which gives the same mileage as in the more expensive model. Some of the details on the new body are weight savers also, as they are in the line of greater simplicity. A good example of this is in the rear corners of the body which were formerly equipped with windows, while in the model 68 these are not installed.

Pressed Steel Used

Pressed steel is used in the structural work on the model 68 chassis, all the assembling being done in the Anderson factory. The cross members, brackets, and gusset plates are hot-riveted with automatic hammers to the side frame members. The cross members are designed to carry the electric motor and the driving units which are assembled upon it. The motor is bolted to the frame in the center and the battery equipment is equally divided. Twenty-one cells of this are in front and twenty-one in the rear, giving a balanced car with the weight on the front and rear axles approximately equal.





Details of rear axle and propeller shaft, together with brake assembly used on the new Detroit Electric selling for $1,775

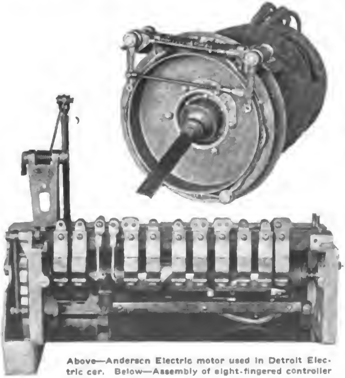
Wiring on Chassis

One of the assembly features of note is that all the wiring is made up in a standard form before it is assembled to the chassis by special cleats. The entire wiring with the exception of the body lights is carried on the chassis.

Timken bearings are used in the wheels with ball bearings for the steering parts and at the knuckles. The friction points in the majority of instances are equipped with self-lubricating bushings and the others with grease and oil cups accessibly located. The standard tire equipment is the Goodrich Silvertown cord.

High-ribbed jars are used in the new Detroit Electric batteries. These ribs are sufficiently high to hold all the active material which will come off the plates during their normal life, thus making a non-wash battery, or one that does not require washing. The purpose of this is to give the user more total life, as some of the active material is always lost during the washing.

Weight is saved in the battery by making it the thin-plate type. It has been found that the thin plates give about the same capacity as the thick plates formerly used, since it is only the surfaces of the plates which really form the active working parts and capacity is a question of area rather than plate volume. With the less weight per plate the new battery has a greater capacity per pound than was possible with the old construction. More plates can be placed in each jar, thus reducing the current used per plate and adding to the life of the battery. The Anderson company now guarantees a battery for 8000 miles or 2 years normal service. The capacity of the Model 68 with thirteen plates, six positive and seven negative, is 150 amp. hr. The battery is located under the hoods, front and rear, so that it is easily accessible for filling, etc. It can be removed by loosening the hold-down bolts.



Above—Anderson Electric motor used in Detroit Electric car. Below—Assembly of eight-fingered controller

A series-wound motor of slow speed characteristics is used on Model 68. The feature of a series motor is that the torque increases with the load, and the electric car is thus enabled to increase its output to accommodate adverse road conditions. By using the slow speed motor, reduction gears have been eliminated with a saving of weight and an increase in transmission efficiency.

Motor 90 Per Cent Efficient

Hess-Bright bearings are used for the armature and as these are packed in grease they require minimum attention. There are four sets of carbon brushes distributed on a commutator of large area giving a high current carrying capacity. The efficiency of the motor is said by the Anderson engineers to be 90 per cent at normal running speed, this efficiency being obtained by using a large amount of copper.

Five speeds forward are supplied by the drum type of controller. This is a finger-and-blade design of large size to carry the heavy current resulting from overloads. As an additional safety precaution there is a self-lubricating felt oiler which rubs against the contacts on the controller, keeping them continually lubricated. Refinement of design has cut the number of fingers on the controller to eight, and this, together with the fact that the reverse switch and cut-out switch are both mounted in the same housing as the controller, has added simplicity and reduced weight. The controller is assembled underneath the rear seat and is covered by a dust-proof housing.

For the main circuits No. 1 wires are used and all the leads are short, as the motor, controller, cut-out and reverse switch are close together. In assembling the wires taper terminals are used sweated to the wires. These terminals fit into taper sockets and are screw-fastened.

Direct drive through a short propeller shaft with two universals transmits the power to the three-quarter floating axle, the drive being through spiral bevel gears. Two separate sets of brakes are provided, those on the rear hubs being internal expanding, 16 by 2½ in., and these are operated by pedal. To the left of the brake pedal is a small pedal, pressure on which locks the hub brakes and automatically cuts off the power. This is for use when parking the car. The second brake operates on the motor and is applied by a slight backward movement of the control lever so that the motion for shutting off the power and applying the brakes is continuous.

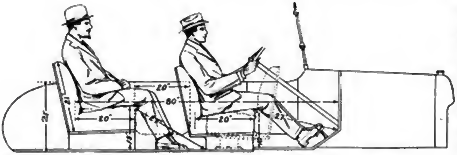
In controlling the car, the operating levers are mounted at the side of the rear seat, in parallel position, one above the other. The longer lever is operated by the right hand and is for steering the car. The shorter lever controls the speed. When the driver leaves the car these levers may be turned up out of the way and locked, preventing theft. Speeds of from 6 to 25 m.p.h. are available, and the mileage per charge is between 75 and 100.

In finish and equipment, the electric brougham affords a vehicle of fine appearance. The fenders are pressed steel, oval-crowned designed and are skirted to the body, protecting it against mud. The standard painting is cobalt blue with white stripes. The wheels are painted in white, cream, red or blue, as specified. The upholstery offers a selection of three designs of whip-cord. It is Turkish type with deep cushions padded with curled hair. With the 100-in. wheelbase chassis a capacity of four passengers is provided.

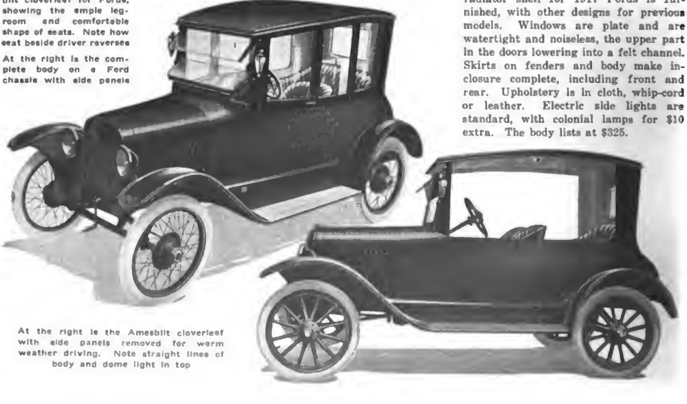
Body features have always been carefully looked after in electrics and the new Detroit incorporates a number of comfort features. There is an upholstered package box in the left front corner which may also be used as a passenger seat. In summer weather the windows may be lowered by a patent device; and the door windows are sashless and are operated by a lever from the inside. The seat widths are generous, the rear seat being 49 in. with 18 in. depth, the door opening 24 in., and the distance from the front to the rear window, 63½ in. Houk wire wheels are furnished exclusively on this model.

Amesbilt All-Season Cloverleaf for Fords

DESIGNED to render possible mounting an up-to-date streamline four-passenger all-season cloverleaf body on a Ford chassis, the Amesbilt construction illustrated herewith has been brought out by the F. A. Ames Co., Owensboro, Ky. As shown in the diagram, measurements have been arranged to provide ample leg-room and comfortable seating, the seat beside the driver being reversible without sacrificing rigidity. Top and side panels are removable but are securely fastened so that rattling is prevented. A special streamline hood and radiator shell for 1917 Fords is furnished, with other designs for previous models. Windows are plate and are watertight and noiseless, the upper part in the doors lowering into a felt channel. Skirts on fenders and body make inclosure complete, including front and rear. Upholstery is in cloth, whip-cord or leather. Electric side lights are standard, with colonial lamps for $10 extra. The body lists at $325.

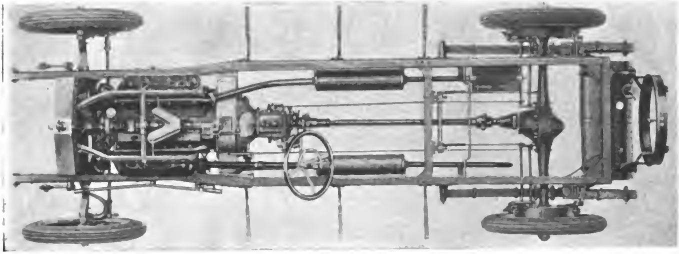


Above is a seating diagram of the new Amesbilt cloverleaf for Fords, showing the ample leg-room and comfortable shape of seats. Note how seat beside driver reverses



At the right is the complete body on a Ford chassis with side panels

At the right is the Amesbilt cloverleaf with side panels removed for warm weather driving. Note straight lines of body and dome light in top



Chassis of the Murray eight, showing the mounting of the unit power plant, position of storage battery, rear fuel tank and tire carrier and the layout of the double exhaust line

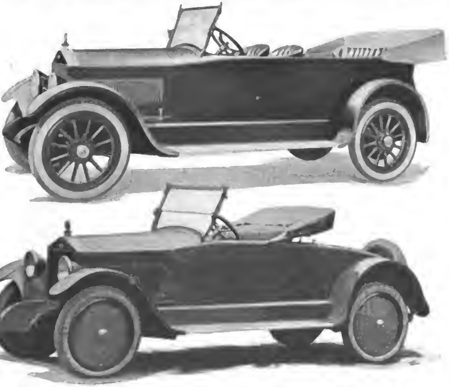
Murray Eight Has Custom Style

Standard Units Used in Substantial Chassis—Appearance Is Distinctive—Equipment Is Very Thorough

THE avowed aim of the Murray Motor Car Co., Pittsburgh, Pa., in designing the Murray eight has been to produce a car of broadly conventional design but with a distinctiveness of appearance and a general soundness of construction in excess of the normal. It is a powerful car and everything about it is after the custom-built style, the equipment being exceptionally thorough, and the price of $2,500 includes the option of finish in any color.

The power plant consists of a Herschell-Spillman engine, 3¼ by 5 in., which is claimed to have a b. hp. of 75, and a Covert three-speed gearset, the clutch being a Borg & Beck dry disk. The axles are both Timken, the floating pattern being used at the rear, and Hotchkiss drive is used, the rear springs being three-quarter elliptic. The electrical units include Westinghouse generator and starting motor with 100 amp.-hr. battery and ignition is furnished by a Dixie magneto.

Rigidity has been aimed at in designing the frame, which is of deep section, and it is dropped a little to give a low body position. The wheelbase of the chassis is 128 in. and 34 by 4½-in. Goodrich Silvertown cord tires are fitted as standard equipment. The smaller details of the chassis equipment include a Zenith duplex carbureter with a Stewart vacuum feed from a tank at the rear end of the chassis. The general equipment comprises every minor detail as well as such important features as an electric clock, a power tire pump, Hartford shock absorbers and a Boyce Moto-Meter.



Two body styles obtainable on the Murray eight-cylinder chassis for $2,500. The European influence is evident throughout the general design of both cars

Chassis Price $2,000

The chassis can be obtained without body for $2,000 and any sort of body is provided that may be called for, the illustrations showing a touring and a roadster obtainable for the $2,500 figure. It will be observed that the general scheme of the hood and body gives a European effect, making the car instantly recognizable.

Wheels are wood, of the artillery type, with the front wheels cambered, this constituting standard equipment, although wheels of other styles may be fitted.

The FORVM

Criticizes Vacuum Brake—Overlooks Important Feature

By H. M. Brayton

AS a student of mechanical engineering, I wish to submit the following criticism based on the article which appeared in THE AUTOMOBILE for Nov. 2, 1916, on the design of a vacuum brake for automobiles by the Prest-O-Lite Co. of Indianapolis, Ind.

The vacuum brakes designed by the Prest-O-Lite Co. seem to be inadequate to meet all the requirements demanded of a power brake for this class of work. Foremost among the faults of this apparatus is the fact that the brake is of absolutely no value unless the engine is running. It very often happens that the automobilist in descending a long grade, wishes to save fuel by allowing his engine to stop entirely. He could not do this unless his car was equipped with another brake and unless this vacuum brake will in itself cover all needs its field of usefulness must be very greatly reduced.

In heavy traffic where the surroundings are noisy it often happens that the engine will stop when the clutch is released and the driver be unaware of it. The brake would again fail with good chances for a smash-up and damages.

In the article mention is made that a difference of pressure of 10 lb. is available from the suction. I wish to show that in the average car with a volume ratio of 3 to 1 we have, assuming Boyle's law to hold and an isothermal suction, that

$$P^1 = \frac{PV}{V^1} = \frac{14.7 \times 1}{3} = 4.9 \text{ lb. absolute}$$

when P and V are the pressure and volume respectively, at the beginning of the suction stroke and P^1, V^1 the same quantities at the end of the suction stroke. This shows that the theoretical limit with this volume ratio is 14.7 — 4.9 = 9.8 lb. difference of pressure available for the brake.

It is a well-known fact that gas engines nearly always exhaust above atmospheric pressure, and so it seems unlikely that the theoretical limit could be reached in practice. However, the lower pressure could readily be multiplied by leverage.

A cylinder 7 in. in diameter seems rather crude and takes up altogether too much space with this size, and a stroke of 4 in., the volume of which must be reduced in pressure before the full force can be exerted on the brake is very large and an appreciable time would be required.

The control valve is indeed an ingenious mechanism, and if the suction were only more reliable this brake would have a wide field of usefulness, especially in heavy work such as heavy touring cars and trucks.

EDITOR'S NOTE—Mr. Brayton appears to have overlooked the fact that this brake must operate as long as the gear is engaged and the car moving. When coasting with the clutch out if the engine stopped it would only be necessary to let in the clutch to obtain suction immediately.

Regarding the pressure available, running with the throttle shut in the idle position the pressure in the cylinder at the end of the exhaust stroke would not be above atmospheric. As to the size of the cylinder, this is by no means so large as a muffler and on most chassis there is plenty of room for it, since it can be mounted almost anywhere.

Melting Scrap Aluminum a Difficult Operation

THE melting of aluminum scrap, particularly chips from machine shops, might, to the uninitiated, appear a very simple process. How difficult it is to perform without excessive loss through oxidation is, however, made abundantly clear by Bulletin 108 recently issued by the Bureau of Mines. This bulletin has eighty-eight pages devoted entirely to this matter. The book is very interesting reading even to an engineer not too closely acquainted with foundry practice and in it, in addition to much very valuable information, there are some interesting figures regarding the quantity of aluminum absorbed by the automobile industry. It is stated that a conservative estimate of the amount of aluminum employed in automobile manufacture in the United States from July 1, 1914, to June 30, 1916, was 50,000,000 lb.

The percentage machined off from a rough aluminum casting in the finishing process seems, from data obtained by the writer, to average about 15 per cent, a figure which is much higher than was estimated offhand by several people connected with the automobile and aluminum casting industries, whose guesses averaged 3 to 4 per cent. The writer's result was reached by weighing rough and finished castings at an automobile plant making a car in the $700 to $800 class, and by weighing rough and finished castings made for various other motor car manufacturers at an aluminum foundry, with the results shown in the accompanying table.

The results of the tabulation, which indicate that 15 per cent was machined off, were so at variance with the estimates cited that the matter was taken up with the makers of a car in the $2,000 class, who state that on that car there are used forty-seven aluminum parts which are machined, the total weight of the rough castings used per car being 166.19 lb. The loss per car in chips is 25.15 lb., or 15.1 per cent. The weights were taken on the average of a number of like parts, in some cases as many as fifty being weighed. On the basis of 15 per cent of metal machined off, the yearly production of chips from aluminum castings in the United States will then run between 3,000,000 and 3,750,000 lb. If 20 to 30 per cent of this amount is unnecessarily lost, then 600,000 to 1,125,000 lb. of aluminum alloys worth 16 to 25 cents per pound, based on the average market quotations in normal times, is lost.

PROPORTION OF METAL MACHINED-OFF ALUMINUM CASTINGS

Casting	Weight of Rough Casting, Pounds	Weight of Finished Casting, Pounds	Percentage of metal machined off, Per Cent
Gear and transmission case	28.50	24.50	14
Small double-flanged exhaust elbows	.42	.35	15
Intake pipe for six-cylinder motor	5.00	4.80	4
Gear case for small motor	8.90	7.00	21
Gear case for very small motor	1.58	1.50	5
Crankcase for eight-cylinder motor	94.00	80.00	14.5

Self-Oiling Bushing's Many Uses

Automobile Industry Will Employ 5,000,000 During 1917

PROBABLY few people are aware that the impregnated self-lubricating bearings which are now used so extensively for light duty parts in automobiles are quite an old idea. Probably it is also seldom realized what a very large quantity of such bearings are now being used by the automobile industry. The Bound Brook Oil-Less Bearing Co., Bound Brook, N. J., will supply nearly 5,000,000 bearings of this sort solely for use on automobiles and trucks during 1917, this figure including the outputs of both bronze bushings with a special form of graphite insertion and wood bushings which are impregnated with graphite.

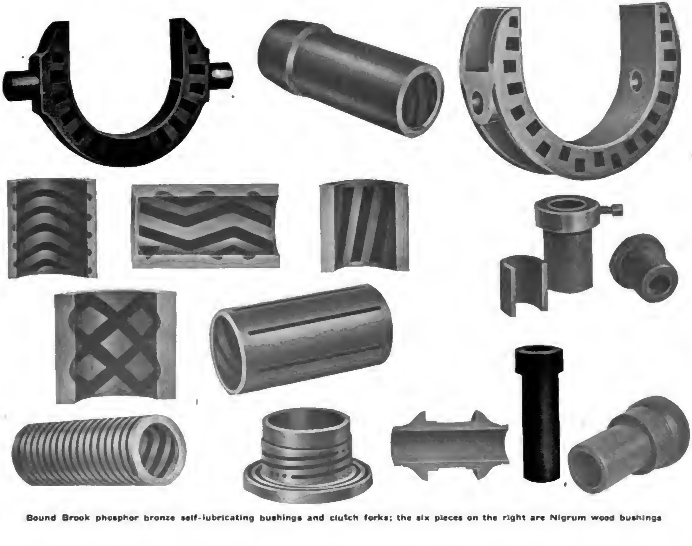
The original Bound Brook bearing was designed for use on electric trolley wheels, where the difficulty of lubrication was a serious trouble. The first batch of bronze bushings with graphite insertion was supplied for this purpose in 1889 and the output of trolley bushings alone is now in excess of a million a year.

Broadly speaking, the oilless bearing is valuable for two different classes of service. For parts with only occasional small motion, such as for the mounting of brake shafts, etc., a graphite insertion keeps the surfaces in good condition and provides all the lubrication necessary, continuing to do this for a very long time. It is even inadvisable to oil them because oil attracts dust, which it may transfer to the rubbing surfaces, while the graphite has no such tendency.

The other sphere of usefulness is in cases where a moderately light duty bearing will normally have a supply of oil, but may be allowed to run dry. A prominent example of this sort of application is the spindle of a starting motor. This is supposed to be lubricated but is often neglected. To use ball or roller bearings would be needlessly extravagant for a part of which only runs for such very brief periods. A Bound Brook bearing can be neglected even more carelessly than a ball bearing, because the latter requires to be protected from damp which would not injure the impregnated bushing.

Quite a different part which it is difficult to supply with oil or grease successfully is the thrust collar used for throwing out the clutch. Here again, we have an example of occasional use and the graphite inserted in the bronze is able to care for the lubrication unaided. Steering gears, pump shafts and many other applications will suggest themselves, and the illustrations give an idea of the many types of bushings made for automobile applications.

The wood bushing which is impregnated right through has a sphere of usefulness distinct from the bronze bushing with graphite insertion. Naturally the wood will not stand up



Bound Brook phosphor bronze self-lubricating bushings and clutch forks; the six pieces on the right are Nigrum wood bushings under the same pressure per square inch that can be supported by the bronze, but wherever sufficient area is obtainable it can be employed because it may be oiled without producing any distortion. This probably is because the pores of the wood are completely filled during the impregnation, the bearings being finish-machined after that process.

Experiments in shackle pin bushing have shown that the wood is a much better material than the bronze, provided the spring eye is large enough to admit a bushing of such size that it will be certain not to split. Where movement is oscillatory and only over a very small angle, the graphite in the bronze bushings does not seem to spread very effectively; there should be a movement of something like 30 deg. to keep the bronze bushing in the best condition, but the wood bushing is not limited in this respect.

It is also highly probable that many uses will be found for Nigrum material, as this impregnated wood is called, in forms other than that of a cylindrical bushing; as an example experiments are being made with slip blocks on textile machines. The impregnated wood can be cut into any shape and the machining is cheap.

The process of manufacture of both the bronze and wood bushings is very simple. The wood is brought roughly to size and is then soaked in a solution containing graphite, after which it is subjected to a secret process, where fairly high temperature and pressure are applied simultaneously. After this treatment the parts are finish-machined and require nothing further done to them. The wood used is ironwood, this having proved the hardest wood that can be impregnated with certainty.

In making the bronze bushes, the grooves which are afterward filled with the graphite compound are cast, since some "tooth" is needed to hold the compound during manufacture. The bushes are finished completely before they are loaded, and to load them the bush is filled with a pasty mixture of graphite and a plunger is then driven through, forcing out the excess and ramming the groove. After this follows subjection to pressure and temperature, the details of which process are jealously guarded, this being followed by baking in ovens. The final process is to push through a plunger which removes any surplus lubricating compound and still further consolidates what is in the grooves.

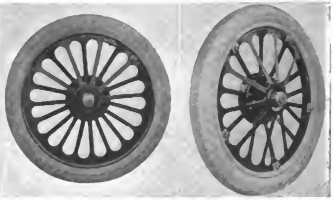
Baker Steel Wheel Has Tension Spokes

INVENTORS of steel wheels are aiming at cheap production, good appearance, strength and convenience. The new Baker steel wheel seems one of the happiest combinations of all four qualities.

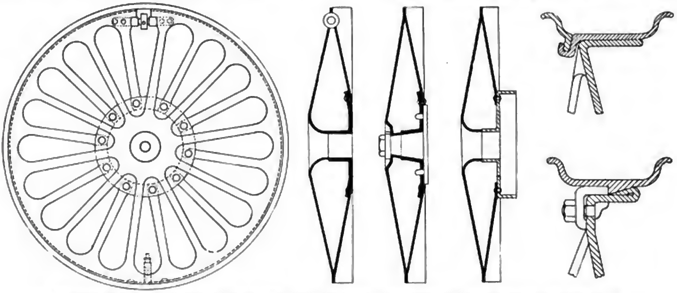
The raw material consists of a disk of thin sheet steel. The first operation is to punch out a number of pieces, so as to leave a set of spokes, joining the rim to the center. Then every alternate spoke is cut off at its inner end where it joins the center piece. This gives two sets of spokes, one set joined together at both ends, and one set with the inner ends free. The second set are then bent sideways and their ends riveted to a steel stamping consisting of a disk with a hub piece pressed out from it, the "hub" being welded or otherwise secured to the center of the original disk; and thus we have a complete wheel needing only the attachment of the rim. Any form of demountable rim can be used and any kind of hub design.

A special rim has been designed for this wheel, this being cut through at a point opposite the valve hole, and a turnbuckle used for contracting it, this being the only part that has to be unscrewed for detaching the rim; there are, of course, some studs or dowels to take the drive.

Plans are well advanced for the manufacture of the wheel on a large scale, both for passenger cars and trucks. The inventor is E. K. Baker, of demountable rim fame, and the patents are held by a new corporation, the Baker Wheel and Rim Co., Chicago.



Examples of finished Baker wheels



Sketches showing the construction of the Baker steel wheel and a few variations upon the basic idea of the device

Lower Fuel Is Greatest Carbureter Problem

Increased Heat, Better Atomization and Higher Jet Velocities the Remedies—Few New Models But Many Refinements

By J. Edward Schipper

ONE consideration, the descending grade of fuel, stands out so prominently as an influence of carbureter design for 1917, that everything else is insignificant by comparison. Mechanically, every manufacturer of carbureters has a different solution for the problem. From an engineering standpoint, however, there are just three classifications of the methods used to meet the issue. These are, in the order of importance, heat, atomization and velocity. The latter two are correlated to a certain extent, but as will be seen by a study of the different types, there is a distinction.

There is a great amount of uncertainty, and has been for some time, regarding the matter of where the carbureter manufacturer ends and the car manufacturer begins in meeting the requirements of the heavy fuel. There is no doubt but that the problems of carburetion and intake manifold design are bound closely together. In fact, the best carbureter made will show poor results on an engine with an improper manifold. Hence the improvements which have been made by the engine and car designers in this respect have advanced the art of carburetion in its broad sense.

No Change in Fundamentals

A year ago, in its review of the subject of carburetion, THE AUTOMOBILE gave a complete classification of the types of carbureters used on American cars. The elapsed period has seen no change in these fundamentals; they remain the same, and yet it can be said that the art of carburetion has gone forward in the past year because the instrument is now coping with conditions which are far more difficult than they were then. The improvements are largely in detail. The details of manifold design, and of carbureter arrangement which have been improved all line themselves under one of the methods of betterment mentioned above; heat, atomization or velocity.

Manufacturers of cars demand from the carbureter manufacturer what the public demands of them. They are asking, in spite of the heavier fuel, for more acceleration, better and quicker starting on frosty mornings, better low-speed, high-gear performance, greater economy, lower idling speeds, better hill climbing ability—that is, increased torque or crank effort at slow speeds with wide open throttle. In fact, everything that goes to make up good car performance is being demanded more vigorously every year by the car-buying public in every grade of car.

Classifying the Carbureters

The manner in which the desired result is attained forms the basic classification of the carbureter. This is really the starting point in carbureter design. The higher speeds, where the energy is at hand, are simple compared to providing an accurate, well broken up mixture at the lower end of the speed range. At the same time, this main jet, or primary device, which supplies the engine at low speeds, must play its part in the wider throttle openings. The ways in which this compensation is made have been classified as follows:

The air valve type, where compensation is made by the opening of an air valve.

The metering pin type, where compensation is made by raising and lowering a measuring pin which governs the jet size.

The expanding type, where the number of jets in action corresponds to the throttle opening.

The compensating jet type, where an auxiliary jet comes into action at wider throttle openings.

Besides these there are miscellaneous special divisions. As carbureters are classified according to these divisions, the well-known makes would be arranged under the heads in the accompanying table.

It will be noted that some makes, such as Stromberg and Rayfield, fall under different heads. This is because they do not purely belong to one class, but employ principles and are of such construction that they fall under more than one head.

This year engines are returning more for a unit of weight and for a unit of displacement than ever before. The carbureter manufacturer is playing an important part in this. The same elements that go to make for economy in carburetion go largely to make good rated performance in an engine. The manner in which carbureters generally have been improved in the lines mentioned differs according to the basis type of the carbureters. What representative makers have

Carbureters Classified

AIR VALVE
Air Friction
Breeze
Zephyr
Shain
K-D
Browne
Branford
Stromberg
Ensign

METERING-PIN
Schebler
Stewart

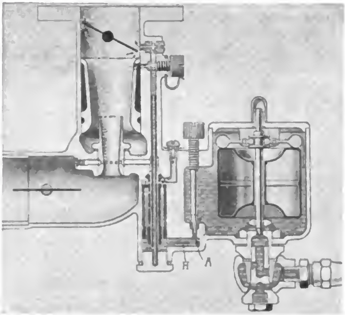
Heath
Newcomb
Rayfield
Tom Thumb
H & N
Webber

COMPENSATING JET
Zenith
Holley
Stromberg
Longuemare
Johnson
Marvel

Ball & Ball
Tillotson
Flechter
Sunderman

EXPANDING
Master
Carter
Juhasz

MISCELLANEOUS
Stromberg
Rayfield
Kingston



In the new Stromberg model L a little mixture flows directly into the manifold above the throttle for starting and providing a good mixture when throttle is practically closed. A is the gasoline feed adjustment and H is the passage to the acceleration well through which the fuel passes from the float chamber

done forms an interesting study, the developments of each being taken up in detail on pages 1022 to 1031.

Stromberg Has a New Design

Stromberg has added an entire new carbureter to its line to take care of the dual problems set up by the higher demands and the lower fuel. In this new plain tube carbureter the general heads under which the improvements are found are atomization and velocity. The atomization is secured by introducing air into the fuel jet so that when it is drawn out it comes out not as raw fuel but as a partially mixed super-saturated vapor, which combines readily with the main flow of air.

The increased-velocity method is used particularly for high accelerative qualities and is used in connection with an acceleration well. When the carbureter is set for ordinary speeds at economy, as a general rule the flexibility has to be sacrificed to some extent. To overcome that the new Stromberg is so arranged that an extra supply of gasoline and air is supplied for acceleration when it is needed. The well fills with gasoline when idling or upon increased suction due to throttle opening, and in answer to the throttle demand this gasoline is drawn at high velocity into the main jet.

New Holley Uses Acceleration Well

A good example of the acceleration well is given in the new Holley. Under ordinary running conditions the well is dry. The well is formed by a bowl-shaped depression below a standpipe through which the mixture is drawn at high velocity. The air enters the standpipe through the bowl-shaped well space and the nearer empty it is the more air in proportion to the gasoline will enter, thus giving the compensation required.

These two makers, Stromberg and Holley, represent the only two who have so far carbureters of new type, and both have retained the fundamental features of their own designs. In practically every other case, the changes may be called refinements of existing types rather than alterations or additions of new principles.

Taking up the matter of acceleration, Schebler will soon be out with a new type, with low-grade fuel, which is one that is uppermost in the minds of carbureter and car makers alike. It will be worth while to note that in both the cases mentioned where marked changes have been made to attain higher acceleration, the acceleration well has been employed where the little supply of gasoline is held always ready to meet the requirements of the engine in picking up.

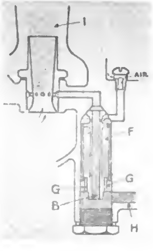
Full Hot Air Another Improvement

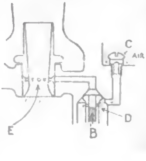
The use of full hot air rather than semi-heated air is another of the changes which are of use in increasing the accelerative qualities. The Master carbureter is an example in which full heated air is now employed instead of semi-heated, that is with primary air hot and auxiliary cold.

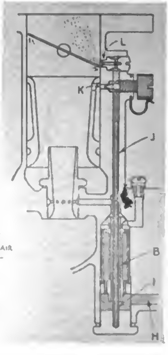
Another distinctive carbureter which should be mentioned in connection with improved acceleration devices is the Ball & Ball made by the Penberthy Injector Co. For easy starting and for acceleration there is a passage from the float bowl to a point above the throttle. This passage contains a plunger and when the vacuum increases it rises and shuts off the flow of gasoline from the intake passage. As the throttle is opened the vacuum in the intake passage is broken and the plunger drops, causing gasoline to gather above it. This is immediately drawn through the passage, giving the extra supply for acceleration.

The above examples are some of the special means taken to increase the accelerative qualities of the carbureters. It requires an additional flow and this must be instantly available or the carbureter will choke and sputter, before picking up its work. In the compensating jet type of carbureter this supply is given by jets uncovered by the opening of the throttle or which are brought into action in some other way by increasing the throttle opening. Carbureters such as the Master, in which the wider open the throttle is the more jets are uncovered, the Johnson, in which the suction raises a sleeve that covers the jet openings, and the Zenith, with a secondary jet surrounding the main jet, are all examples where the compensating jet takes care of acceleration. On the Zenith there is also a well, but this is used to supply

In the Stromberg L air enters at E, and through C and B, carrying fuel which is sprayed into the main channel. An accelerating well F concentric with passage B is filled with fuel. At speed air is drawn through C, forcing gasoline to join the general flow, the well returning to normal level when the extra demand of the engine is relieved







the secondary jet and is not open like that of the Marvel, Stromberg and Holley types.

Securing Easy Starting

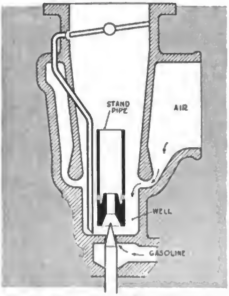


Diagram of new Holley model K, showing provision for feeding mixture direct into manifold above throttle for starting and low-speed work

The problems of acceleration and easy starting are somewhat allied, but differ in one material respect, and that is in the amount of throttle opening. When starting the throttle is nearly closed, when accelerating it is wide open. In both cases, however, a quick supply of gasoline is required, with a mixture richer than in ordinary running. For this reason on some of the carbureters the same device that acts for easy starting also helps in the way of acceleration. A good example of this is the Zephyr, which is a plain tube type of carbureter. A ball valve has been added at the bottom of the air tube and when the throttle is opened it causes a lag of the air behind the gasoline. A sudden throttle opening for quick acceleration will cause a spurt of gasoline to enter the intake, thereby enriching the mixture and giving the qualities necessary for acceleration.

This same device acts as a help for easy starting. When the engine is stopped the ball valve drops to the bottom, thereby cutting the air supply and causing the primary starting suction to fall on the nozzle and the supply of raw fuel needed is given.

As far as methods of securing easy starting are concerned there have been no innovations during the year. The majority of carbureter manufacturers have come to use an easy starting tube which connects the intake above the throttle directly with the float bowl. This provides the heavy mixture for idling as well as for starting. When the throttle is closed a high vacuum is created even at slow rotative speeds, and this vacuum falls on this easy starting passage taking in a flow of pure gasoline. There are several variations of this basic method used on the different makes.

New Air Regulation Features

Two trends in connection with the starting problem are noteworthy. These are in the increased use of dash controlled air, to help out the automatic devices used on the carbureter, and the use of an increased proportion of heated air. Both these are matters which are up to the car manufacturer as well as to the carbureter maker. The use of jacketed intakes and steering column and dash controls has increased to such a large extent that one carbureter maker, Marvel, has had to bring out a modified design intended particularly for cars with very hot intakes. The modification was made by taking the standard model E design and removing the exhaust-heated jacket. The new carbureter is called model F. It is provided with a full heated air intake and it is claimed that with a well-heated intake and this preheated air, the carbureter is particularly suited to the low grades of fuel now in use.

Low Speed Performance Problems

While the demands for acceleration and easy starting have been high, it is doubtful if they have been as difficult to meet as the low speed performance requirements. When the eights and twelves began to show 3 and 4 m.p.h. on high gear, with ability to accelerate from that speed advantageously, the makers and users of sixes and fours, regardless of the fewer impulses per revolution, demanded quite close to the same thing for their cars, and put the matter up to the carbureter manufacturer.

It has always been recognized that carburetion difficulties are great at low motor speeds, because of the lack of energy at the carbureter jet. The mixing of air and gasoline in the proper condition for combustion is, after all, a mechanical proposition. It means so much work done, and therefore must involve the factors of load and distance. The energy supply is provided by the vacuum or suction. It is utilized in breaking up the gasoline, in drawing in the air, and carrying the combined charge into the intake manifold.

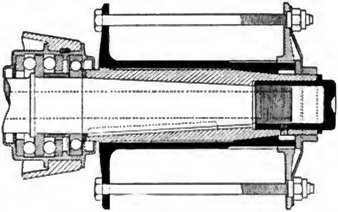
When an engine is turning over slowly the gas is not pouring into the cylinder at a high rate of speed, and naturally the kinetic energy necessary to break up the fuel is lower just at the time it is necessary to have the fuel well broken up to provide a good explosion for low speed work. By various means carbureters are arranged to give a richer mixture at these low speeds so that what air is drawn in will be thoroughly saturated with the gasoline vapor.

Elsewhere the different types of carbureters are discussed individually. The constructions of carbureters are in as many different forms as there are carbureters. The problems all have to meet are the same and the foregoing will show what these problems are and how, in general, carbureter manufacturers are meeting them.

A German Aeroplane Propellor Hub

THE Aeronautic Engine Division of the Standards Committee of the Society of Automobile Engineers has been devoting considerable attention to the design and possible standardization of propeller hubs. At the first meeting it was suggested by Howard E. Coffin that a quick-detachable device similar to that of the Rudge-Whitworth wheel might be used and shortly afterward almost precisely this idea was patented by the Rolls Royce of England.

The accompanying illustration shows an application made to the British patent office by a German company shortly before the war. It will be noticed that there is a bush secured to the shaft by a key and a nut and that the actual propeller hub fits over the bush. Driving is done by teeth cut on the outer end of the brush and on the inside of the hub. These teeth are tapered so that when the hub is locked into position by the securing nut there can be no shake.



A German design of aeroplane propeller hub

Few Changes in Carbureter Design

Four Fundamental Types Still Unaltered—Two New Carbureter Constructions—Principles in Use Are Greatly Intensified as Compared with Models of a Year Ago

INDIVIDUALLY, carbureters have not been changed materially during 1916. The four fundamental types described in THE AUTOMOBILE classification of a year ago still hold true. Up to the date of going to press there are two new carbureters which differ materially from the products of the same makers of a year ago, and even these are not changed in basic principle as much as in mechanical structure.

Along the line, however, there have been refinements which are more in the nature of intensifying the principles already in use rather than in the introduction of new ones. The increased demands of the public and, in turn the car manufacture, on one hand, and of the descending grades of fuel on the other, have made necessary alterations which carry out to an even greater extent the purposes which were clearly defined in carbureters a year ago.

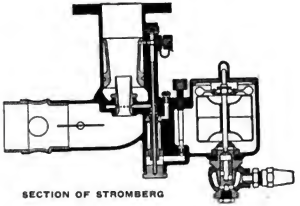
A greater amount of heat, a finer division or atomization of the fuel and a higher velocity of the mixture are the three basic improvements. All three of these can be traced directly to the heavier fuel to a greater extent than to the higher demands of the manufacturer, although both play their parts.

Three types of carbureter are almost equally popular. The air valve type, in which compensation for varying throttle openings is made by the air valve, has 28 per cent. The metering pin and compensation jet classes each have 25 per cent. The expanding type numbers 11 per cent, and the miscellaneous groups, which are not distinctively under any of the above heads has also about 11 per cent. There are some carbureter manufacturers whose products fall under more than one of the above classifications.

While the air valve type is numerically slightly stronger than any of the other classifications, the compensating jet class has gained two powerful recruits during the year. Stromberg is just adding a new carbureter of this type whereas its former designs were of the air valve class. There is also the new Holley which belongs under this head.

Differences in Stromberg

The new Stromberg compensating jet carbureter is a plain tube type, all air being preheated and taken through a straight, uninterrupted tube. It is made in both horizontal and vertical types and in style adapted to passenger cars, as well as constant load vehicles, such as trucks, marine engines and tractors.



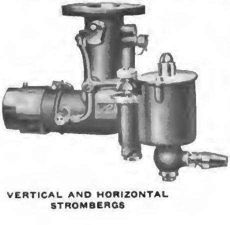
SECTION OF STROMBERG

The new plain tube carbureter differs from the previous types of Stromberg, particularly in what the Stromberg company calls an air-bled jet. In this the air is introduced into the gasoline before it emerges from the jet. The jet has a series of holes drilled around the throat of the venturi. There is also an arrangement for supplying a small quantity of gasoline above the throttle in idling.

Three features are incorporated in the new carbureter to meet the demands for easier starting, better idling, and acceleration with low grade gasoline. The first of these is the air-bled jet which consists in the introduction of a small, measured amount of air into the gasoline jet before it sprays out into the main air passage. This air forms a series of small bubbles which atomize the fuel and break the surface tension, causing it to flow readily at a low vacuum. The introduction of the air is dependent upon the suction in the manifold and thus the flow corresponds to the vacuum in the intake and is proportional to the air flow through the plain tube.

Referring to the sectional view of the carbureter, it will be noted that gasoline leaving the float chamber through a regulating orifice rises through a vertical channel, while air drawn in by suction through the protecting cap discharges into the gasoline channel or air-bled jet, breaking up the gasoline which issues in a number of small jets into the high velocity air stream in the venturi passage.

The second feature is the accelerating well. A small pool of gasoline is kept in communication with the main fuel passage so that at low throttle a supply of gasoline accumulates here and is held ready to supply the needs of a quick throttle opening for acceleration. When the extra demand is relieved, the gasoline in the well again returns to the normal level of the



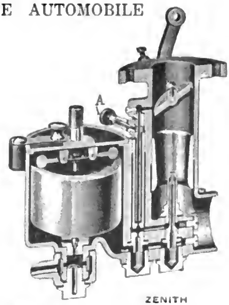
VERTICAL AND HORIZONTAL STROMBERGS

fuel in the float chamber of the carbureter.

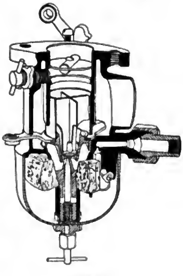
The third feature of the new Stromberg is its idling arrangement by means of which at closed throttle a small quantity of mixture flows directly into the manifold above the throttle so that the suction at idling speeds is sufficient to carry into the intake a column of gasoline from the float chamber.

Starting with fully closed throttle, the carbureter first draws gasoline from the small idling opening above the throttle. Then, as the throttle is opened further, gasoline is drawn from the main orifice into the venturi in the plain tube. At high speeds the air velocity through the venturi in the plain tube is so great that practically no fuel passes through the idling nozzle.

An economizer has been added to the Stromberg carbureter which is designed to produce a richer mixture needed for power at wide open throttle. This is a T-shaped part, having at its upper end a roller resting on a cam which turns with the throttle, and its lower end resting on a second cam operating the main air shutter. The horizontal portion of the T ends in a shoe upon which rests the adjusting nut, controlling the high speed gasoline meter. The shape of the cam on the throttle is such that the needle is raised slightly at closed throttle, lowered for ordinary driving positions ranging from 15 to 35 m.p.h., and raised again as the throttle is opened for speeds above this. A rich mixture for starting also is provided by cam on the main air shutter which raises the needle slightly, giving a rich mixture.



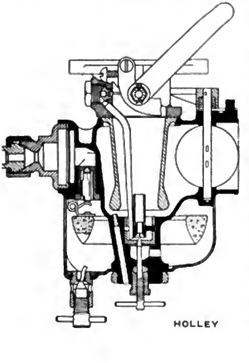
ZENITH



JOHNSON

New Holley Instrument

The new Holley compensating jet carbureter is an improvement over the previous Holley in that it has an increased capacity with decreased fuel consumption. The new model is known as K and the model G, Ford type, and the HA are continued without change, except for detailed alterations in the float mechanism, giving a better fuel control. The mixture flow is regulated by the vacuum at the jet, the intensity of which is controlled by the amount of throttle opening and by the varying positions of the actual air throat in the choke tube from which it is transferred to the jet by means of a standpipe, the constructional being shown in the illustration. The standpipe extends up from an accelerating well, in which gasoline lies in a pool for use when throttle is closed.



HOLLEY

As the throttle is opened wider, the gasoline does not have time to fill the well and hence a mixture of air and gasoline is taken up. The wider open the throttle, the greater the proportion of air, giving the compensation effect for high speeds. The only adjustment is the needle valve at the bottom which governs the flow of gasoline into the well.

The Ford type is the same as the above in principle but has no standpipe. It has, however, a well and all the Holley models have an easy starting tube which leads the gasoline from the well to a point above the throttle. There is also a dash-operated choke on the air line.

Zenith Unchanged

No new Zenith carbureters have been introduced during the past year. The models which are being continued over are L, O, HP and OD (Duplex). The only alteration on these is that on the Duplex type there are individual butterfly adjustments.

The flow in the mixture in Zenith carbureters is accomplished by regulation of the nozzle opening and by regulation of the air supply. This brings the carbureter into the compensating jet class. Uniform vacuum is maintained in venturi and elements depended on to secure vaporization of low grade fuel are, finely divided jet spray, high velocity and heat.

The carbureter has as a primary the fixed nozzle in the venturi. The secondary jet surrounds the primary and feeds fuel through the same venturi. The secondary jet draws its supply of gasoline from a well at the bottom of the easy starting tube. At idling speeds this tube is full of gasoline up as far as the level in the float chamber, thus feeding a rich mixture. At running speeds the gasoline in the tube is exhausted and the flow is sucked through the well passage into the secondary jet along with a supply of air. There is an idling adjustment on a needle valve and no other adjustments on the carbureter.

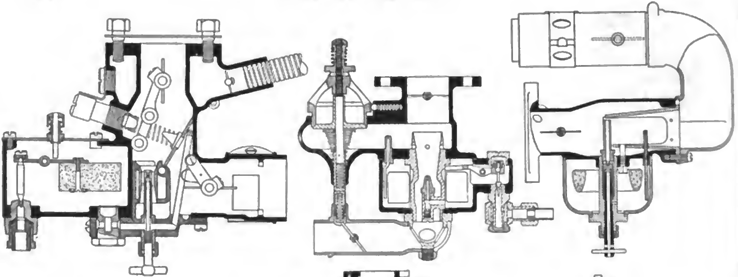
In buying Zenith carbureters the make and year of the engine should be known as the jets and choke passage must correspond. As in all carbureters the intake should be the same diameter inside as the carbureter. There are no special points in installation which do not apply to all carbureters.

No New Johnson Models

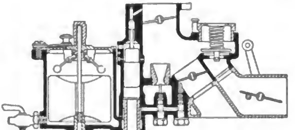
No new models have been added to the line of Johnson compensating jet carbureters. In this, the fuel flow is governed by an automatic sleeve air valve in a cylindrical mixing chamber. The cylindrical sleeve is concentric and carries a small plate at the bottom which regulates the jet passages and governs the mixture. In operation, suction of the engine raises the sleeve, allowing it to float automatically at the proper level to secure the correct jet area. There is a dash choke which rotates the strangling tube, shutting off all air.

Marvel Adds New Model

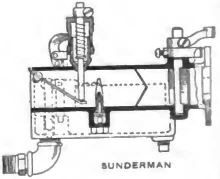
A new compensating jet model, known as F, has been added by the Marvel company. As far as the carburetion



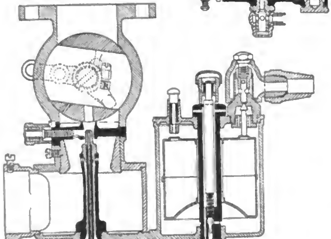
ABOVE FROM LEFT—MARVEL, FLECHTER AND TILLOTSON



BALL & BALL



SUNDERMAN



LONGUEMARE

elements are concerned this is the same as the previous model, E, but it is designed for engines with hot intakes and consequently it is made without the exhaust-heated jacket used on other Marvel carbureters. In addition to the new model, the standard model E and the model N Ford type have been continued with improvements. The alterations are in the nozzles, jets and air valves, which increase the velocity and at the same time atomize the fuel more finely. The fuel flow is regulated by an auxiliary high speed jet which is uncovered by the auxiliary butterfly air valve. The fuel is vaporized by the spray nozzle jet in the venturi and by the application of heat.

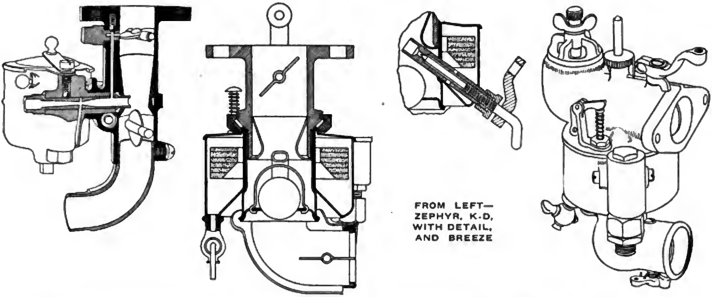
Ball & Ball Two-Stage Type

An interesting compensating jet model is the Ball & Ball, which its manufacturers call a two-stage instrument. It is really two carbureters in one, the primary being made up of a simple jet in a venturi passage. The second stage comes into play when the throttle is open and is made up by an independent air passage containing a separate air valve which uncovers the compensating jet. For easy starting, there is a passage which leads from the float bowl to a point above the throttle. In this passage there is a plunger which acts as a pick-up device. As the throttle is opened the vacuum in the intake passage is broken, allowing the plunger to fall and causing gasoline to gather above it. This is immediately drawn through the pick-up passage, giving the desired mixture for acceleration. There are no adjustments on this carbureter.

Tillotson, Flechter and Longuemare Unchanged

Three other carbureters, the Tillotson, Flechter and Longuemare, which are in the compensating jet class are unchanged. The Tillotson, which is known for its use on the Willys-Overland cars, has added a new model, however, which is simply the previous model B converted into a vertical type instead of being horizontal. In the Tillotson carbureters, a uniform partial vacuum at the fuel nozzle is maintained by means of two easy-yielding flexible reeds mounted on a cage designed so that the maximum opening takes care of the volume required to fill the combustion chamber at maximum speed. When the reeds are seated the primary nozzle supply is located in a small choke passage to give the highest possible vacuum at low throttle openings. The virtual effect of these flexible reeds is to give a variable venturi. only one air inlet is used so that a sufficient amount of heat is supplied for vaporizing the heavy fuel.

In the Flechter carbureter, the mouth of the venturi inclosing the main nozzle is carried up higher than the compensating nozzle. In operation the primary nozzle takes care of low speeds and when the throttle is open the auxiliary air valve drawn air passed the compensating jet. The latter leads into a well which is open to atmospheric pressure, so that at high speed air is taken through this jet, while at lower speeds gasoline also enters through it. This gives the necessary compensation.



FROM LEFT—ZEPHYR, K-D, WITH DETAIL, AND BREEZE

In the Longuemare, the main jet is shut off with closed throttle. As the throttle is opened the main nozzle comes into use and a further opening draws a mixture of air and gasoline through the supplementary nozzle. Thus, the compensating jet is directly functioned by the throttle.

Sunderman a Compensating Jet Type

Sunderman carbureters belong in the compensating jet class. There are two tapered nozzles at right angles to the air flow and the passage of the air past them creates a high vacuum directly at the nozzles. The mist thus formed is further broken up and gasified by passage through a screen.

In operation, as the motor is started, the suction raises the air valve which is held closed merely by gravity. The valve opens just sufficient to permit the air to sweep over the lower of the two nozzles. As the engine speed increases, thus increasing the suction, the air valve raises higher, thus bringing into play the second nozzle which is higher.

Air Valve Types Are Most Numerous

INCLUDED in the air valve types are the Zephyr, Air Friction, Browne, Branford, Breeze, Shain and K-D. Of these, alterations have been made during the year by Zephyr and Air Friction. The Branford, which at present is supplied only in the Ford size, will be made in all sizes after Jan. 1, 1917, without change in principle.

The air valve carbureters are probably the most simple of all types. Either automatically or mechanically an auxiliary valve opens at higher speeds, decreasing the richness of the mixture to take care of the needs of increased speeds. Primarily, the auxiliary air valve is necessary to relieve the vacuum at the main jet caused by the increased velocity of the air current. As engine speeds increase beyond 1000 r.p.m. the auxiliary air valve become necessary, and it was from this type that the inspirations for the more complicated automatic devices were drawn.

Zephyr Adds Ball Valve

The Zephyr is a plain tube instrument which has been refined this year by the addition of a ball valve at the bottom of the tube. The object of the change is to put more suction on the gasoline jet, thus securing better atomization of the heavier gasoline. The standard Zephyr type without the ball valve is being continued. A uniform partial vacuum is maintained by the venturi shaped air passage, through which the air flows at right angles to the main jet. In the new model the ball valve is seated at the bottom of the tube with a smaller air valve above it, so that primary air is taken above the ball and the auxiliary air secured by lifting the ball with the vacuum in the intake. The air through the primary opening is heated, and through the opening below the ball is cold.

The atomizer and jet runs from the float bowl into this air passage at right angles and the velocity of the air over the interior end of the atomizer creates sufficient vacuum within it to spray the fuel into the venturi-shaped mixing chamber. The atomizer has four different jet openings which line up with the intake from the float chamber. The adjustment is made by turning it until the proper opening is in line. There is also a throttle jet which is in the form of a tube running above the throttle, acting as an easy starting device and idling feed, on closed throttle. A starting shutter in the bottom of the air tube throws all the suction on the atomizer and insures a good starting mixture.

Browne Has Changeable Intakes

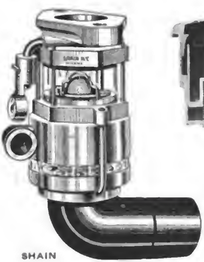
Browne carbureters belong in the air valve class though the air valve in this case is controlled directly by the suction in the venturi. The auxiliary air valve is an aluminum cup held on its seat by a spring and sucked open in proportion to the speed of the engine by the rush of air passing and opening directly opposite the fuel nozzle. Therefore, any change in the fuel flow automatically changes the quantity of air mixed with the fuel. The internal construction of the Browne is scientifically proportioned to the requirements of the motor. The size of the venturi and of the auxiliary air inlet is changeable, and is determined by the piston displacement of the motor.

Breeze an Air Valve Construction

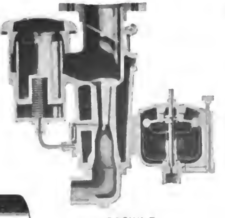
The Breeze carbureter is a simple air valve type. The incoming air passes through a venturi inclosing the fuel nozzle so that the suction determines the quantity of fuel drawn through the nozzle. As the mixture would be too rich at high speeds without the addition of more air, there is an auxiliary air valve controlled by a spring.

Air Friction Is Unchanged

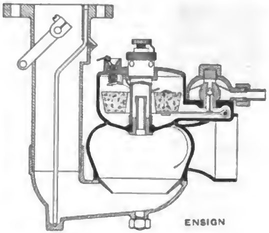
Air Friction carbureters are of the air-valve type in which the auxiliary air valve maintains the proper proportions of



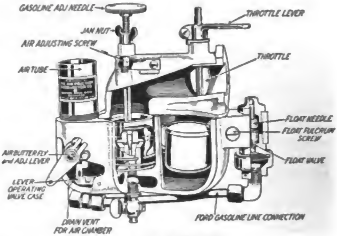
SHAIN



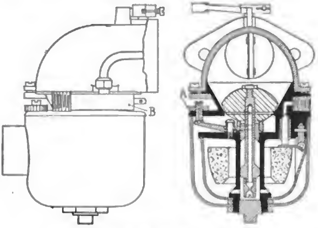
BROWNE



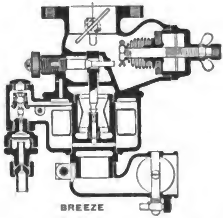
ENSIGN



AIR FRICTION



TWO VIEWS OF BRANFORD



BREEZE

gasoline and air. There has been only one change in this carbureter for 1917 and this consists in an improvement in the spray nozzle, holes being drilled in the lower collar.

K-D Has One Adjustment

Belonging in the weighted air valve class, the K-D is a simple instrument in which there is but one adjustment. Air entering the intake lifts a ball which permits the proper amount of air to enter the carbureter in proportion to the speed of the engine. As the air enters it picks up fuel from a single nozzle which projects into a venturi.

Shain Uses No Float

The Shain carbureter is a combination of weighted air valve single jet types. The jet is normally closed by a bronze ball which is raised off its seat by the rush of air thus permitting a certain quantity of fuel to mix with the air. There is no float, the ball over the jet preventing leakage of fuel when the motor is stopped.

In operation, the rush of air causes the ball to rotate and thus to throw out a thin mist of gasoline which is mixed with the air, which also is rotating, and thus passes on to the cylinders.

Branford Employs Constant Vacuum

The Branford carbureter belongs in the constant-vacuum weighted air valve class. The fuel is drawn up through the center of this weighted air valve and issues from orifices around the circumference of the valve where the velocity of the air is greatest. Inasmuch as the amount of fuel picked up is governed by the velocity of the air passing the fuel nozzles and the velocity in turn is controlled by the vacuum which remains practically constant, the quality of the mixture does not change with the change in volume required by the motor.

At present but one size for Fords is made but at the New York shows there will be on exhibit a full line operating on the same principle and intended for all makes of cars.

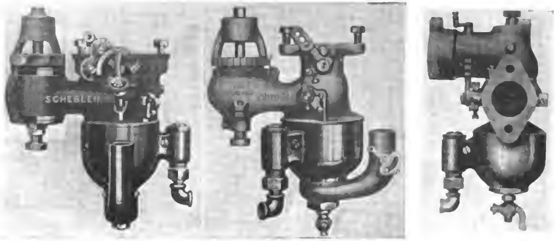
Ensign Is Different

The Ensign carbureter is radically different from anything else of the kind. The mixing chamber is directly beneath the float chamber. Air enters the mixing chamber and is converted into a whirling current which centers about the fuel inlet. Suction on the fuel inlet draws fuel into the air where it is thoroughly mixed. Admixture is assisted by the passage of the mixed gasoline and air through a constricted area before it enters the outlet to the manifold.

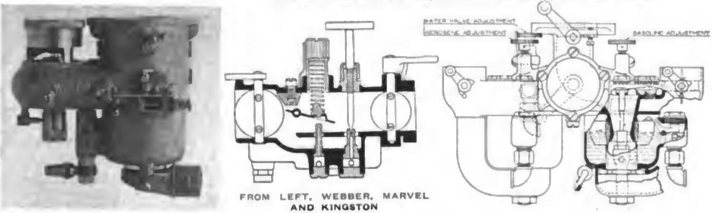
To permit the richer mixture required by extreme low running there is an unbalanced butterfly valve in the intake. This is horizontally placed and when the motor is idle hangs down so that the intake is partly closed. The slowest air movement causes it to shift its position so as to increase the amount of air admitted. It affects the working mixture only at extremely slow speeds.

The carbureter is made in three types, for gasoline, distilate and heavier fuels and is made in all the usual sizes from 1 in. to 2½ in. varying by ¼ in. sizes.

Some Standard Carbureter Designs



THREE SCHEBLER MODELS, ALL IN THE METERING PIN CLASS

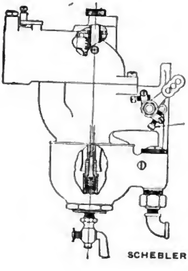


FROM LEFT, WEBBER, MARVEL AND KINGSTON

Carbureters of the Metering-Pin Class

SOME of the best known carbureters used on up-to-date cars are classified as metering-pin carbureters. They include such makes as Schebler, Stewart, Rayfield, Newcomb, H & N, Webber, Heath and Tom Thumb. In this type, the raising and lowering of a calibrated pin governs the size of the fuel opening in proper relationship to the engine requirements.

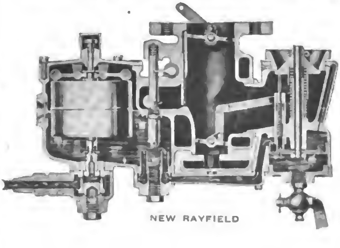
Wheeler & Schebler has a new model which is just about ready for announcement, although details cannot be furnished at this time. Aside from this, there are no new models, those which are carried over being R, L and P. These are what may be termed the overcompensated type in which the needle is lifted to a greater extent than normally would be required giving a wider fuel opening with the proper air compensation secured through the air valve. The needle is hooked to the air valve and when the latter lifts it lifts the needle. This applies directly to the model L and the model T is inverted type of model L and R, in which the needle is depressed to open. Proper atomizing of the fuel is provided by the velocity of the air carrying the fuel off the nozzle, by maintaining a large velocity and by heating the air.



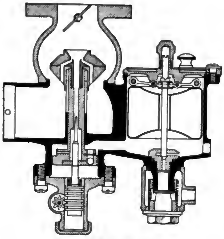
SCHEBLER

Rayfield Metering Pin Improved

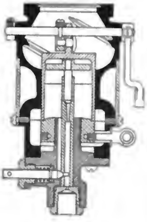
The chief improvement in Rayfield carbureters is the re-



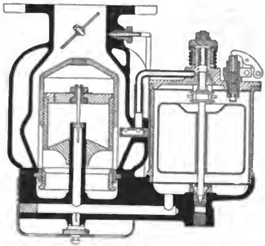
NEW RAYFIELD



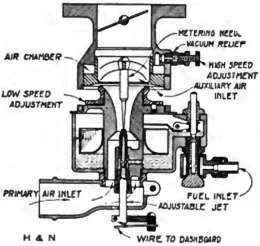
STEWART



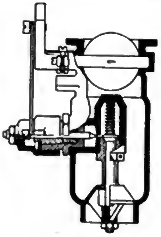
HEATH



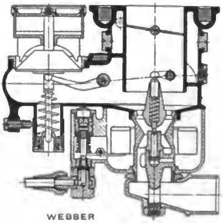
NEWCOMB



H & N



TOM THUMB



WEBBER

arrangement of the metering pin, which is operated by the upper air valve. Previously this pin was held against the air valve by a spring, and the valve had to overcome the reaction of the spring to operate it. Now the metering pin rides on the dash pot piston, which is on the lower end of the air valve stem, and moves upward and downward with the valve, but without requiring any greater effort by the valve.

Findeisen & Kropf, the manufacturers, are continuing the model G as the chief feature of its production program for 1917. This is not a new model, but the above detail refinements designed to give quicker acceleration and take care of the lower grades of fuel have been made. While the model G is the prominent one of the line, there is a model L the same in every respect except that it is not water-jacketed, which is the horizontal type of the model L.

Rayfield is classified as a metering pin type, but it goes further: It incorporates an auxiliary nozzle, which also has a metering pin which is depressed when the auxiliary air valve opens. Thus by having two distinct nozzles it establishes its right also to be classified as an expanding type of instrument. But Rayfield goes still further in that it combines a pumping action on the gasoline in the auxiliary nozzle whereby a very rich mixture is furnished for acceleration whenever the air valve is opened suddenly. This is accomplished by the piston on the lower end of the air valve stem, this piston working in a dashpot filled with gasoline. Gasoline enters the dashpot above the piston and is admitted to the space below the piston by the disk valve in the piston. When the air valve suddenly opens, forcing the piston downward, this disk valve is closed automatically, forcing or pumbping the gasoline upward through the fuel passage into the nozzle, where it is sprayed into the inrushing air. Only when the valve opens is this pumping function occurring and at other times the gasoline issues through this auxiliary nozzle according to the suction of the motor. Thus Rayfield is a compound of two metering pins in conjunction with the pumping function for acceleration. The dashpot also prevents air valve fluttering.

Stewart Line Unaltered

No new models and no changes are incorporated in the Stewart line. This is a metering type of carbureter in which the vacuum at the jet is controlled by the weight of the metering valve surrounding the upright metering pin. The only moving part is the metering valve which rises and falls with the changes in vacuum. The air chamber surrounds the metering valve, and there is a mixing chamber above. As the valve is drawn up, the gasoline passage is enlarged on account of the predetermined taper on the metering pin and the air passage is also increased propertionately, giving the correct mixture. A dashpot at the bottom of the valve checks flutter. In idling the valve rests on its seat practically closing the air and giving the necessary idling mixture. There is a passage through the valve which acts as an aspirating tube. When the valve is altogether closed the primary air passes through ducts in the valve itself, giving the proper amount for idling.

Newcomb Adds Pulverizing Plunger

Newcomb carbureters belong in the metering pin class and have had a pulverizing plunger added. The reason for this plunger is to more thoroughly mix the gas line and air and thus to assist in its vaporization. In addition to the main nozzle there is an auxiliary nozzle which leads to a point opposite the throttle to assist in starting.

Air entering the carbureter lifts the pulverizing plunger which in turn lifts the needle out of the nozzle, permitting a certain quantity of fuel to escape into the chamber. This fuel passes through a number of small holes at the bottom edge of the plunger, these holes registering with an equal number of narrow air slots in the plunger tube. The air rushing through these slots mixes thoroughly with the fuel. The head of the plunger and the upper end of the plunger chamber form a dashpot.

Webber Metering Pin Models

Several models of metering pin types of Webber carbureters are made and they all operate on the same general principle. The nozzle is located in a venturi, as usual and the size of the orifice is altered by raising a needle, or pin, out of it through interconnection with the auxiliary air valve. The peculiarity of the Webber is that the mixture of air and gasoline, after leaving the nozzle, is caused to pass through a series of smaller venturi tubes arranged in a circle around the main venturi and above it. This causes the air and gasoline to be thoroughly mixed and vaporized.

H & N Control by Auxiliary Air

H & N carbureters belong in the metering pin class in which movement of the measuring device is controlled by the auxiliary air through an air dash pot. The primary air passes through a venturi, picking up its fuel from the nozzle in passing. For low speeds the fuel nozzle remains unchanged but at higher speeds the opening of the auxiliary air valve raises the metering pin and proportions the gasoline to the air which is flowing through the carbureter.

Heath Employs Vacuum

The Heath carbureter belongs in the metering pin class in which the quantity of fuel is proportioned to the air by the action of an air valve operated by the vacuum induced in the carbureter. In principle there is a valve floating on a tubular shaped column of air which rushes past the six openings of the fuel stud. The position of this valve depends upon the volume of air going through the carbureter and as the valve lifts it lifts the metering pin with it.

Tom Thumb

The Tom Thumb carbureter is a metering valve type in which the opening of the throttle increases the opening of the fuel port around the needle. This is accomplished by a connecting rod which turns the needle on a coarse thread to pull the needle away from the opening. When the engine is at rest a shut-off valve is pushed to a closed position by a spring. When the engine is running this valve is held open by the air valve. The fuel outlet is through six small holes.

Expanding Types Include Interesting Designs

ALTHOUGH the expanding types of carbureters are only 11 per cent of the total, they include some of the most interesting of all the modern designs. Among them are the Master and Carter. In these carbureters the jets come into action as they are needed starting with a primary for idling with jet after jet contributing its share of fuel as the throttle is opened further.

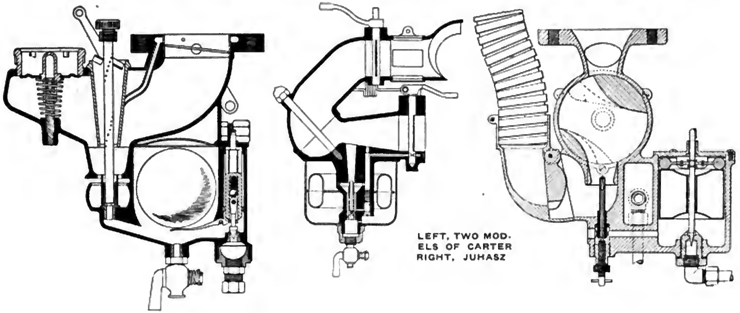
Master in Single Model

The Master carbureter is continued as a single model. Its principle of operation is the breaking up of the fuel by means of a series of jets which vary in number from 14 to 21, according to the size of the carbureter. These are uncovered by opening the throttle which is curved—a patented feature—in order to secure the correct progression of jets. The carbureter has an eccentric float chamber from which the gasoline is led to the jet piece from which the jets stand up.

The tops of these jets are closed until the throttle is opened far enough to pass them, which it does progressively. The air opening is at the bottom and the throttle opening is such that a modified venturi is formed. The throttle is carried in a cylindrical barrel with the jets placed below it and the passage from the barrel to the intake is arranged so that there is no interruption in the flow. For easy starting there is a dash-controlled shutter which closes off the air, throwing the suction on the jets, thus giving a rich mixture.

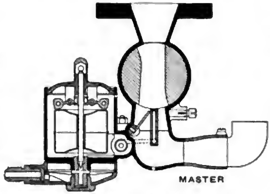
The only adjustment is for idling and once that is fixed it need never be touched. This is in the form of a screw and regulates the position of the throttle when at idling position. The dash control has high-speed, normal and rich starting positions.

The minor modifications on the Master are as follows: New design brackets for float weights, formerly integral lugs on cover. New steel stamping locked to float chamber with projections which fit into slots. This locks cover on float, whereas a circular wire was used. Float needle now monel



LEFT, TWO MODELS OF CARTER
RIGHT, JUHASZ

metal instead of brass. All hot air now instead of semi-hot air.



MASTER

New Carter Warms All Air

It has been mentioned that the three basic methods for taking care of the heavier fuel are by increased heat, better atomization, and higher velocities. The Carter carbureter uses all three, in its new model L which has just been put on the market. All the air that enters the new Carter instruments is warmed and comes through one opening. It is brought into contact with the various jets by means of venturi tubes permitting the passage of an exceptionally large volume of air to the engine with noteworthy increase in power and passing the jets at a very high rate of speed, thus greatly assisting in the atomizing process.

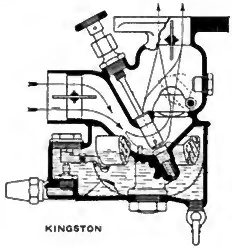
Five Models of Same Type

There are five models of Carter carbureters, all being the automatic expanding type. These are models C, hot water jacketed with low and intermediate adjustments which can be sealed after being set, designed for replacement business, on account of adjustability to varying conditions; Model CH, similar but designed for six, eight and twelve-cylinder cars; Model F, used for equipment purposes and also for special Ford outfit. It has no adjustment except a limited one for the float level. Model H is similar except that it has a steel float chamber. Model L has all the air received through one intake. It is designed especially for speed and power and easy starting. It is used only for equipment purposes except in the Ford outfit.

Juhasz Has Fixed Orifices

The Juhasz instrument belongs properly in the expanding carbureter class. It has a number of fixed orifices which are uncovered progressively as the rotary throttle is opened. Each orifice gives in effect an independent carbureter. At slow speed only one orifice is in operation and as the throttle is opened the second, and then the third, orifice comes into operation.

There are only three moving parts: the rotary throttle, the float and an auxiliary gravity operated air valve to control the admission of air to the middle carbureting chamber. With the throttle closed this valve is on its seat and permits just sufficient air to pass to give a rich mixture for idling. As the speed of the engine is increased the air valve lifts, increasing the flow of air in proportion to the increased flow of fuel and thus keeping the fuel supply in the proper proportion for various throttle conditions.



KINGSTON

Kingston in Miscellaneous Class

NONE of the four classifications given above suits the Kingston carbureter. Several Kingston carbureters are produced. For pleasure car use there is the Model L, which is applied as stock equipment on a large percentage of the Ford cars, and developed with slight changes for application to other cars. In addition, there are a number of models brought out for tractor, marine and stationary service under the general designation of Inclosed type, being designed for operation under conditions in which there is a great deal of dirt and dust in the air, the feature being that all the air is taken in at one intake, which may be protected from dirt. Of these, the Kingston Duplex is the most interesting, as it is arranged to operate both on kerosene and gasoline, having two float chambers, two nozzles, two mixing chambers, with a three-way valve to the manifold. Thus, it is in fact two distinct carbureters, one for gasoline and one for low-grade fuel, having only the connection to the manifold as a common part. This carbureter retains the old Kingston feature of ball valve.

Model L Heats All Air

The model L, which is the later design, has a concentric cork float around a jet placed at an angle from the vertical. The air, all of which is heated, is taken in through a single opening and swept downward through a curved passage whose shape gives it the proper velocity and direction to sweep across the end of the flat nozzle, thus picking up the fuel. The suction is regulated automatically by means of a flapper valve which assists in acceleration and whose action is explained below.

There is always a pool of gasoline at the base of the tube when the motor is not running. This is for the purpose of positive starting. When the motor starts this pool is quickly lowered to a lower portion of the tube, depending on the adjustment of the needle valve and continues to feed from this point until the motor is stopped.

When the motor is running slowly the air valve rests lightly on its seat, allowing no air to pass, consequently all air must pass through the low-speed tube, as the lower end of this tube is close to the spray nozzle and all the air at low speed has to pass this point, the atomized gasoline drawn from the nozzle becomes thoroughly mixed with the air in its upward course.

As the throttle is opened the air valve rises, permitting a small volume of mixture to pass by, due to the suction of the engine. At this point a change in operation occurs. The low-speed tube still continues to deliver a perfect mixture, but is being assisted by the air valve opening. The air must pass across the spray nozzle between it and the low-speed tube. As the motor speed is increased up to its maximum the air valve continues to rise higher, permitting more and more air, which passes across the spray nozzle with no increase in velocity and picking up the gasoline from it.

Industrial Miscellany

Factory

American Auto Trimming Co., Cleveland, has leased quarters in which it will establish a plant.

W. A. McManus and F. A. Hagner, of Newark, N. J., have formed the General Safety Signal Co., with a capital of $500,000 to manufacture safety signal devices for automobiles.

Crown Tire & Rubber Co., Omaha, Neb., is about to start the building of the first unit of a tire and rubber plant, for which 5 acres has been purchased in a manufacturing suburb of Omaha. The company will produce 300 tires and 250 tubes daily. It is planned to have the building up and machinery installed about Aug. 1 next. An output of fifty tires a day, both cord and fabric types, will be undertaken in a temporary location.

K. D. Carbureter Co., Cleveland, will erect a new three-story concrete factory, 100 by 250 ft.

Sayres & Scoville Co., Cincinnati, carriage builder, will enlarge its factory to devote its manufacture to automobiles and special motor trucks.

H. P. Miller, Fort Worth, Tex., plans to build a plant at Dallas for the manufacture of an automobile appliance.

Saunders Motor Power Co., East St. Louis, Ill., is preparing to equip a plant for the manufacture of a rotary motor operated with steam, gas or gasoline. J. H. Keys is president.

Midcontinent Tire Mfg. Co., Wichita, Kan., will build the first unit of its plant. This will cost $65,000 and will be two stories, 60 by 280 ft.

Pierce-Arrow Motor Car Corp., Buffalo, N. Y., will erect a sand blast and pickling building of steel construction.

Anger Engineering Co., Milwaukee, will build a plant at Twenty-sixth and State Streets.

Locomobile Co. of America will erect a one-story, 100 by 160-ft. addition.

B. P. Motor Car Co., Peoria, Ill., has been incorporated to manufacture motors for automobiles and other machines. Temporary quarters have been secured at 418 Main Street. A new building is planned on Hamilton Street, to be erected as soon as the old opera house structure is demolished. The officers of the company are as follows: President, E. T. Beatty; vice-president, R. U. Pfeiffer; secretary-treasurer, J. S. Pfeiffer.

DeLion Tire & Rubber Co., Trenton, N. J., is about to erect a three-story, 65 by 175-ft. addition.

Alpha Rubber Mfg. Co. will locate its plant in Genoa, Ill. The company is capitalized at $1,000,000 and will occupy the piano factory in the west end of the city. It will manufacture tires. Seventy-five men will be employed at the beginning. J. A. Berger is president and general manager.

Atwater Kent Mfg. Co., Philadelphia, manufacturer of ignition systems, is erecting a one-story factory building at 4937 Stenton Avenue.

Autocar Co., Ardmore, Pa., recently marked the close of one of the most successful years in its history by entertaining its salesmen and branch managers at the factory. Among those in attendance were W. T. Savoye, New York; J. E. Higgins, Providence; R. P. Page, Boston; M. S. Bulkleym, Los Angeles; K. B. Harwood, Chicago; A. H. Bishop, Baltimore, and A. E. Fisher, Newark.

J. B. D. Resilient Wheel Mfg. Co., Milwaukee, which was organized about 3 years ago to manufacture and market a solid-tire wheel for passenger cars and trucks, has changed its corporate style to the Motor Parts Machine Co. The plant at 675 Smith Street has been extended and enlarged to include the production of a varied line of car, truck and tractor parts for the trade.

The Automobile Calendar

ASSOCIATIONS

Jan. 6-13—New York, Mid-Winter Meeting of Society of Automobile Engineers, Engineering Society Bldg.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Feb. 1-2—Chicago, Ill., Annual Convention American Assn. of Garage Owners, Auditorium Hotel.

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R. Gates, Mgr.
Dec. 26-27—Olean, N. Y., Show, Armory Hall.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City: Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 25-27—Asheville, N. C., Show, Asheville Automobile Trade Assn.
Jan. 27-Feb. 3—Columbus, Ohio, Show, Memorial Hall, Columbus Dealers' Assn.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 27-Feb. 5—York, Pa., Show, York Automobile Dealers' Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 28-Feb. 3—Wilmington, Del., Show, Hotel duPont.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12 - 17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 12-19—Indianapolis, Ind., Show, Steinhart Bldg., Indianapolis Automobile Trade Assn.
Feb. 19-24—Grand Rapids, Mich., Show, Automobile Business Assn. of Grand Rapids.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 18 - 25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory, J. J. Callahan, Mgr.
Feb. 19 - 24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto. Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 24 - March 3 — Brooklyn, Show, 23rd Regiment Armory.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3 - 10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Automobile Trade.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.
April—Calumet, Mich., Show, Coliseum, Frank Ketchell, Mgr.

Elgin Motor Car Co., Chicago, has completed a ¾-mile test track, over which every car is tested before shipment. The Elgin factory is also located near a steep hill, which provides opportunity to test the hill-climbing qualities of every car.

Sheller Wood Rim Mfg. Co., Portland, Ind., manufacturing single-piece wooden rim automobile steering wheels, is making plans for a factory.

Davis Mfg. Co., Milwaukee, a manufacturer of gasoline engines for trucks, tractors, railway coaches and similar purposes, is reported to be preparing to make important works extensions, made necessary by the extraordinary demand for its products. The new building, it is said, will consist of a shop, 124 by 225 ft., and a pattern shop, 30 by 90 ft.

Elwell-Parker Electric Co., Cleveland, maker of storage battery industrial trucks and tractors, will enlarge its plant by the erection of a four-story building, 60 by 120 ft. This will be a duplicate of an extension built some time ago. A third unit of the same size is contemplated early next year.

Personals

J. F. Douse has been appointed sales manager and advertising manager of the George W. Miller Co., Seattle. Previous to this change Mr. Douse was manager of the Seattle branch of the Fisk Rubber Co. Mr. W. P. Williams will remain as general manager of the George W. Miller Co.

Herbert Dovey has been appointed manager of the Sturgis & Storie Co. of Walla Walla, Wash., agent in Walla Walla for the Buick, G. M. C. trucks and Bull tractors.

H. C. Plow has purchased the Automobile Owners' Accessory Co., Ltd., of Montreal, Can. Mr. Plow, who is known to the industry as "Hy" Plow, was at one time treasurer of the Hartford Rubber Co.

J. E. Morehouse is manager of the Detroit branch of the Scripps-Booth Corp. The branch was recently opened.

George Grow, Boston, used-car dealer, has purchased from the Willys-Overland Co. the four-story building on West Newton Street that had been used by the Connell & McKone Co., eastern Massachusetts Overland dealer, as a service station for the past 5 years.

R. C. Wilson has been appointed general manager of the Columbus Cadillac Co., Columbus, Ohio, succeeding E. C. Moliter. Mr. Wilson has been a director and sales manager of the Standard Motor Car Co. there.

V. A. Seiders has been appointed Southern sales agent for the Bell Motor Car Company, York, Pa., and will cover the States of Virginia, North Carolina, South Carolina, Georgia, Alabama, Florida and Tennessee.

A. B. MacGowan, formerly in the sales promotion department of the Chase Motor Truck Co., Syracuse, N. Y., is now city sales manager for that company at its Philadelphia branch.

D. F. Shanahan of Covington, Va., has joined the sales force of the Chase Company as special traveling representative.

F. L. Terry, who for the past 4 years has had service on S. G. V. and Fiat cars, has taken in a partner, R. E. Hardy, and opened an accessory store at 1441 Bush Street, San Francisco. The firm is known as Terry & Hardy, accessory dealers and Firestone distributors.

H. E. McEldowney of Seattle, Wash., has been appointed agent for the Hendrick's 1-ton truck attachment in Tacoma, Wash., and surrounding territory.

S. W. Dorman has become purchasing agent of the automobile accessory department of the Biddle Purchasing Co., New York.

Jack De Mont, Atlanta, Ga., for more than a year manager of the Willard Storage Battery Co. branch, has been transferred to New York and Al. C. Hyser of Cleveland, Ohio, succeeds him as Atlanta manager.

A. H. Abel, Birmingham, Ala., has become sole owner of the Abel-McCay Wagon Co. and has changed the name to A. H. Abel Wagon Co. In addition to automobile repairing the company will sell Redden trucks.

N. B. Ford, who for 10 years traveled for the Corbin Screw Corp. from its Chicago office, having his headquarters in Kansas City, and who left some 2 years ago to become connected with the Ford Chain Block & Mfg. Co., Philadelphia, has re-entered the employ of the Corbin Screw Corp. as salesman, with headquarters in New Britain and covering the territory formerly traveled by A. H. Harrop.

C. B. Lindeman, formerly Western advertising representative of the Firestone Tire & Rubber Co., has been appointed head of the creative division of the company with offices in Akron.

W. J. Denning has recently been appointed manager of the cataloging and advertising departments of the Auto Parts Co., Chicago.

J. L. Hamilton, secretary of the Bay State A. A., has formed a partnership with Stanley Hall, one of the directors, and it is named the H. & H. Motor Specialties Co., to handle accessories.

W. E. Hennigan, for many years with the Winton New England branch, and Herbert Ramsey, a former Hupmobile man, have joined the sales force of the Harry Fosdick Co., handling the Pathfinder at Boston, Mass.

J. J. Devaux has resigned as Oregon distributor in Seattle for the Chevrolet car in order to take the agency for the Regal car in Lower California.

F. H. Downes has been appointed head of the Smith Form-A-Truck department of Ballou & Wright of Portland, Ore.

W. E. Duersten, formerly production and efficiency expert of the Western Electric Co., and later connected with the Hudson factory, has been named factory superintendent for the Macon Motor Co., Macon, Mo.

O. R. Randall, for 7 years sales manager of the Middle Western and Southwestern territory of the J. I. Case T. M. Co., Racine, Wis., has resigned, effective Jan. 1, to engage in business at Atlanta, Ga., as State distributer for Georgia of a line of pleasure cars, trucks and tractors, the names of which are not yet divulged. Mr. Randall joined the Case Company in 1901, first as agent in Atlanta. In 1909 he was called to the home offices to accept one of the most important posts in the sales organization. His son, E. A. Randall, now associated with the Western Advertising agency of Racine, will become associated in the new venture at Atlanta.

E. A. Jacob succeeds J. W. Wildman as manager of the Des Moines, Iowa, branch for the Portage Rubber Co. Mr. Wildman leaves to take charge of the Chicago Portage branch.

J. B. Brugler has been appointed manager of the new Indianapolis branch of the Racine Horse-Shoe Tire Co., Racine, Wis., which has just been opened at 249 North Pennsylvania Street.

H. P. Nelson has become treasurer and sales manager of Robert Lurie & Co., New York, handling the Metz.

Dealers

Kelly-Springfield Tire Co. has opened a factory branch at 1225 Harmon Place, Minneapolis, succeeding the Boger-Stiess Rubber Co., its agent for 2 years. G. M. Martin, manager for the Firestone Tire & Rubber Co. branch at 1635 Hennepin Avenue, is appointed manager. The territory is Minnesota, the Dakotas, western Wisconsin and western Canada. A. C. Searles is new manager for the Firestone company.

F. B. Stearns Co. of New York announces that the wholesale end of its business is now in charge of the factory branch. The wholesale business was formerly handled by Charles E. Riess & Co., metropolitan distributor of the Hupmobile.

Metz cars will be distributed in Chicago by James Haddie at 729 Lyman Avenue, Oak Park.

Troy motor truck trailers will be handled by the Barden Electric & Machinery Co., Houston, Tex., and by the O'Rourke-Muller Motor Co., New Orleans.

Chalmers Motor Co., Detroit, has issued to all its dealers plans for an effective service inspection. During 1917 each Chalmers dealer or distributor will maintain a Standard Chalmers service car which will be distinguished by its color scheme of red and black. This car will have a red body, black hood and running gear.

Willard Storage Battery Co., Cleveland, has added during the past month about sixty new service stations, making the total up to 831.

Benton County Hardware Co., Rogers, Ark., a wholesale hardware concern, which operates a string of retail stores and travels a number of salesmen, has added automobile accessories to its jobbing line. The company is contracting accessories on a jobbing basis and compiling an extensive catalog.

Packard Motor Car Co., Philadelphia, will build an eight-story steel and concrete service plant, 70 by 185 ft., at Broad and Wood Streets.

Padgitt Bros. Co., Dallas, Tex., has closed contracts for the Texas agency for the Kelly-Springfield and Commerce trucks and for the Babcock and Parry commercial bodies and for the Racine tires.

Cole Automobile Co., Peoria, Ill., has removed from 1812 Main Street to a new location at 103 Ellis Street, and will operate a sales agency, garage and service station. Eugene Hayden is now distributor for the Cole in Peoria and vicinity.

Denver Auto Goods Co., Denver, has taken the Colorado distributing agency for Pennsylvania tires.

R. E. Williams Motor Car Co., Denver, a new concern, has secured the Abbott-Detroit distributing agency for Colorado and southern Wyoming.

JOHNSON'S
GUARANTEED
CARBON REMOVER

Your Car Will Run Like It Did The First 500 Miles—

if you keep it free from carbon—the black plague of motorists. The quickest, easiest and cheapest way to remove carbon from your cylinders is with

JOHNSON'S CARBON REMOVER

Five minutes time and no labor required. Lift your hood and pour an ounce of Johnson's Carbon Remover in each cylinder through the petcocks or spark plug openings. Put down the hood—go to bed—get up in the morning and drive a perfectly clean engine. You can save from $3.00 to $5.00 over any other method without loss of time and with much better results.

SPECIAL OFFER

We will send you by prepaid express for $1.00 (bill or stamps) enough of Johnson's Guaranteed Carbon Remover to thoroughly clean any ordinary four-cylinder motor three times. Please give us the name of your dealer.

S. C. JOHNSON & SON, Dept. A, Racine, Wis.
(Patent Applied For)

Takes out that Knock
and
Puts new Life in Your Engine

RAYFIELD CARBURETORS

Foremost in Automobiling and Aviation

Used by Miss Ruth Law in All Her Record-Breaking Flights

MISS Ruth Law, now recognized as America's greatest aviatrix, has used the Rayfield Carburetor on her aeroplane in all her exhibitions—looping-the-loop and night flying—and recently stated that the Rayfield has made it possible for her to do her flying successfully.

Miss Law, in her famous Chicago-New York flight of Nov. 19-20, using the Rayfield Carburetor, established the following records:—

American Non-Stop Cross-Country Record;

American Non-Stop Cross-Country Record for Women;

The Second World's Aviation Record.

Rayfield Records Unrivaled

While the Rayfield of today is best known as the most efficient carburetor for all motoring purposes, it has also earned its fame by performance in the establishment of other world's records on race track, motor boats, motor truck endurance contests and economy runs.

Findeisen & Kropf Mfg. Company
2117 Rockwell Street, Chicago

New York Automobile Show
Spaces C-89 and 90
Chicago Show
Space 36 (Gallery)

BRANCHES:
1902 Broadway, New York
1140 Michigan Ave., Chicago

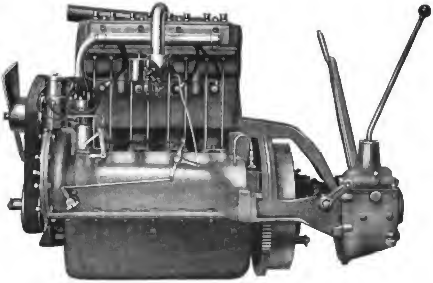
Value

THERE is abundant evidence to prove that the four cylinder motor is the ideal motor, and scarcely any evidence to the contrary. Most foreign manufacturers of quality cars—and it is generally admitted that there is no superior to high quality foreign cars—use four cylinder motors. Even the six cylinder motor has never yet come into its own abroad, and yet all of the multi-cylinder propositions have been tried.

Again, it is generally admitted that greater power and efficiency—which mean more miles with less fuel consumption—is possible with valve-in-head construction than with any other kind of motor. Ample proof of this statement is shown in the fact that practically all of the great racing cars where both power and speed are desired both here and abroad use four cylinder motors of the valve-in-head type.

MONROE

TOURING CAR $985



The four cylinder valve-in-the-head motor of the MONROE car has the large ports of a high speed motor. The cylinder heads are cast enbloc and include the intake manifold. The cylinder block is cast integrally with the upper part of the crank case. The cylinders have a $3\frac{1}{4}''$ bore with $4\frac{1}{2}''$ stroke and a piston displacement of 150 cubic inches. The front crank shaft bearing is $1\frac{3}{4}''$ in diameter by $3''$ long. The clutch is of the multiple disc type, using six dry plates of Raybestos and steel. The cam shaft is hardened and ground.

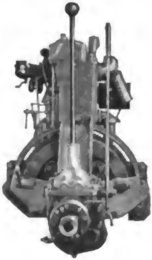
So following established engineering practice, the MONROE motor is a four cylinder motor, valve-in-head type, refined to the very last degree. It is such a motor as manufacturers generally will revert to after the sales value of the multi-cylinder type has been lost.

The Significance of the M & S Differential

Another point of construction which demonstrates clearly the high quality of the MONROE product as a general proposition is the use of an M & S Locking Differential.

This M & S differential possesses all of the advantages of the old conventional type differential, without any of its disadvantages. The old type differential of course provided differential action when a car was turning corners, but it also admitted of idle spinning of the wheels during straight ahead driving moments, which caused cutting and undue wear of the tire—and which also assisted materially in causing car skidding and which made it practically impossible to pull a car out of a bad hole in the event of only one wheel having traction.

This new M & S differential provides perfect differential action during the moment that the car is turning corners, but when the car is driving in a straight line, it automatically prevents the wheels from revolving at a speed greater than that at which the car is traveling.



Does Away With Spinning

In other words, if in driving over a cobble-stone pavement the rear wheels bounce and jump off the pavement—as they always do, when they return to the pavement they are revolving at the same speed as that at which they were turning when the car left the road.

The M & S differential prevents this idle spinning and scuffing, which does more to wear out tires than could possibly occur if the differential were entirely eliminated.

In addition to this, the M & S differential stops car skidding before it starts by preventing either of the wheels from spinning or skidding when you strike wet pavements. It also provides that if one wheel has traction that wheel will get the same power that the wheel without traction gets, and thereby ensures your being pulled out of a mudhole.

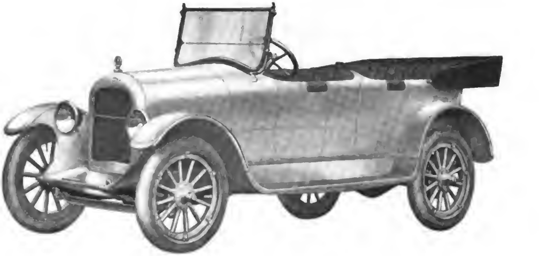
Other Valuable Features of Construction

As stated above, these two features of construction in the MONROE car are mentioned largely as particular evidence of the general design and quality construction of the car itself. They are cited only to indicate clearly the fact that the MONROE car is of high quality without any extravagant non-essentials.

The other features which regard for the perfection of the MONROE car have com-

It has been our aim to make the MONROE car as attractive in appearance as it is well built and designed. It is finished in a way that conforms to the quality that is in it. It is not flashy or rakish in any degree, but neat and compact with graceful, well-balanced lines suggesting refinement, together with strength and speed. The Monroe car will be found large and roomy. It has been especially designed for comfort. You get plenty of leg room.

MONROE



pelled us to include, have all received the sanction, of leading engineers both here and abroad. With the three already mentioned they may be tabulated as follows:

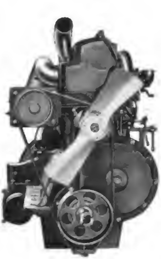
1. Valve-in-head motor construction.
2. The use of a highly developed, highly refined 4 cylinder motor.
3. Pressure oiling.
4. Deep frame construction.
5. Compound cantilever springs.
6. Detachable cylinder heads.
7. Equal tractive differential.

Not only is the MONROE car amply large for all sorts of uses, not only is the MONROE car a beautifully well-finished car with a striking, snappy appearance, but all of its attractiveness that immediately impresses the prospective buyer is more than borne out by the performance of the car itself.

It has that snap and power which is possible only with the valve-in-head motor and yet it is an economical car to drive, giving high gasoline and oil mileage, and because of the locking differential, an exceptionally high tire mileage.

An Equipment Matched Only in Highest-Priced Cars

In addition to all these facts, the car is complete from one end to the other, with every quality part and accessory that any motor car owner could desire. By glancing over the specifications it will be apparent quickly that nothing has been omitted—nothing essential to performance and comfort.



Only High Grade Units

You find in the MONROE car, a Zenith carburetor; Connecticut Ignition driven from the cam shaft, in combination with a belt driven Auto-Lite Generator; Auto-Lite Starting Motor with Bendix Drive operating on the fly-wheel; Fedders Radiator with thermo-syphon cooling system and auxiliary tank; compound springs with self-lubricating shackles; Raybestos clutch and brake lining; Stewart-Warner vacuum feed; selective type, sliding gear transmission, three speeds forward and reverse; nickel steel gears, double heat treated; ball bearings throughout; indeed, all the essentials of equipment that are to be found in any car at any price. In the line of more general equipment you find a Motometer Stewart-Warner Speedometer, eight day clock and tonneau light with No. 1 leather trimmings and silk mohair top. Wire wheels are furnished at extra cost.

There are lots of cars on the market that compare with the MONROE as to size, selling for lots less money. And that is just the point we wish to make here. The MONROE car was not built to sell at a price. It was built to meet the demands of the man who wanted a quality car and yet who did not want a great, big, heavy, high-powered, expensive and extravagant conveyance that would be beyond his means or requirements. We found we could build such a car to sell for $985.

MONROE

There is a vast field of just such motor car prospects—men who want all the quality that is necessary to ensure pleasure and comfort, and yet are not willing to pay two or three thousand dollars for their car.

The MONROE car supplies this demand.

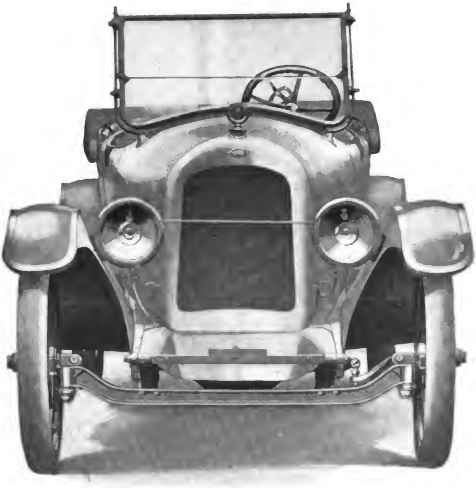
A Unique Opportunity for High-Grade Representatives

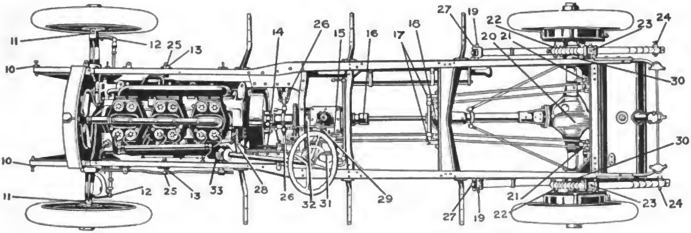
It is a car which calls for quality representation. It is a car which can be sold only on a quality basis. But on that basis the MONROE car sells and sells easily.

We are looking for a broader and wider distribution. We want men to sell this car who know how to approach people who realize that in the long run it is cheapest to buy the best. If you are in position to handle such a proposition as that, we want to get in touch with you.

Our proposition to you is liberal, in fact, it is more than liberal, for we are building and want to build in the right way with right people. Get in touch with us immediately.

MONROE MOTOR COMPANY
PONTIAC MICHIGAN





"Down" Must Come Your Car When Most Any of These Scores of Bushings Wear Out

Consider seriously, please, for the sake of your own pocketbook, the important part that the bushings play.

The quality of the bushings used in a car invariably determines the amount of service the car will render before it begins to rattle and lose power and have to be overhauled.

Bushings of bronze, you know, are used to take the wear between most relatively moving parts.

There are scores of such bushings in every car and when they wear, *even slightly*, rattles and knocks, vibrations and lost power, invariably result. Worn bushings, too (because looseness allows vibration, causes crystallization of other parts), are frequently the cause of dangerous accidents.

When you have your car overhauled what are you going to do?

Have it built up with medium quality bushings which have short life or with bushings of the finest quality?

To replace the worn bushings in your car with Non-Gran, your repairman will have to charge you five or six dollars more than were he to use the ordinary run of bearing bronze.

Non-Gran bushings are the finest he can give you and their use will save you many hundreds of dollars by eliminating future repairs.

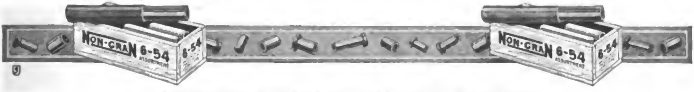
If the cost for overhauling, using medium quality bushings, would be $100.00, the cost for this same overhauling, using the finest quality bushings, would be about $105.00.

Practically every manufacturer of high grade cars and motors uses Non-Gran bushings. That's why these finer cars wear so much better and longer than ordinary cars not so equipped.

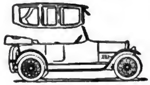
American Bronze Company
Berwyn - - - Pennsylvania

Sole Makers of Non-Gran Bronze and Largest Exclusive Manufacturers of Bearing Bronze in the World.

HIGH SPEED
NON-GRAN
BEARING BRONZE



Kissel's Original Idea That Changed the Motoring Habits of a Nation



The Hundred Point Six

The car of a Hundred Quality Features. Quick on the get-away—its mighty Kissel-built engine smiles at the veriest creep in heavy traffic and laughs at 60 M. P. H. when you "let 'er out."

Hundred Point Six
ALL-YEAR Models

Mounted on Gibraltar Body	
Touring-Sedan	$1635
Roadster-Coupe	$1635
Victoria-Town Car	$1950

Hundred Point Six **without ALL-YEAR Feature $1195**

Hundred Point Six **with Gibraltar Body . . $1285**

De Luxe "6-42," 7 Passenger **. $1750**

De Luxe "6-42" Sedan, 7 Passenger **. . . $2100**

F. O. B. Factory

KisselKar *The* ALL-YEAR *Car*

THE refined atmosphere and custom-built appearance of the ALL-YEAR Car emphasize the delights of Yuletide.

The privilege of sitting behind the wheel, driving the mighty Kissel-built engine—the ease with which you thread your way through the crowded streets, shut in from the winter elements, create an admiration for such ***master coach-building.***

The exclusive and distinctive top ***is built in***—not on—housing you in an atmosphere hard to define, intangible to describe, but delightful to experience.

The ALL-YEAR Top is ***not*** a stock top. You do ***not*** find it on cars of all prices, but ***only*** on KisselKars. Remember that when purchasing.

DEALERS—We are holding open excellent territory for the right men to represent Kissel's ALL-YEAR Car and HUNDRED POINT SIX. To such men we *offer* unusual business opportunities. Business particulars on request.

Kissel Motor Car Company
Hartford, Wis., U. S. A.

Johns-Manville Fire Extinguisher

Talk plain fire extinguisher to a man and your words may go in one ear and out the other. But talk protection and he'll show immediate interest. He'll buy protection when he won't buy just an accessory.

Take the man with a $1500 car. It requires no argument to convince him that $8.00 invested in a J-M Fire Extinguisher is mighty inexpensive protection for his original investment.

When you reach this point—the extinguisher sold—then you clinch it by showing him the two-way method of operation, an exclusive J-M feature. The J-M Fire Extinguisher can be discharged while you pump, or a few quick strokes store enough pressure to discharge its contents in tight places where there is no room to pump.

Price including bracket
$8.00 Brass or Nickel Finish as desired

Our policy of strict trade protection and generous, uniform discounts regardless of the quantity you buy, assures you of a liberal margin of profit. Write our branch nearest you—TODAY—for details.

As a result of the tests made under the direction of the National Board of Fire Underwriters, the J-M Fire Extinguisher has been approved by and bears the label of the Underwriters' Laboratories, Incorporated. To motorists this means a 15% reduction on automobile insurance.

H.W.Johns-Manville Co.

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

New York City

Branches in 54 Large Cities

LIGHTNESS

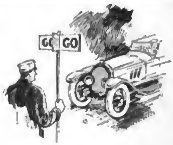
Lightness is the word today in motor-car construction.

Frame, axles and superstructure are made of stronger, lighter materials.

The high-speed motor is smaller and more compact than its clumsy predecessor.

Lynite aluminum alloys had already solved the weight problem for over forty motor-car parts. Now comes the new Lynite Piston Alloy "122" which has solved the greatest problem of all.

It weighs about a third as much as cast iron, lightening the pressure and friction on cylinder walls, the hammer blows on crankshaft and connecting rod bearings, and the effort of starting and stopping the dead weight of cast iron in your cylinders 3000 times a minute.



ACCELERATION

Like the greyhound or thoroughbred race horse which is off at a flash—so Lynite Pistons give you the full power of your motor with instant response.

Relieved of that heavy load of cast iron inertia, the car leaps forward with a swift, smooth rise in power.

The succession of power impulses is unbroken. The vibration due to the cast iron battering ram in the motor is done away with.

You get this quicker response not only in starting but under all the conditions of driving.

Up the hills on high, slowly through crowded traffic or rushing along on the straight-away, your motor is like a thoroughbred, instantly responsive to the lightest touch of the rein.

LYNITE

STRENGTH

The strength and wearing qualities of the new Lynite Pistons are as astonishing as their lightness.

They have a hardness and uniform, close-grained structure previously unknown in alloys of aluminum.

This is due both to their composition and to the unique methods by which they are cast—assuring results impossible with ordinary sand castings.

They do not soften at the high temperatures of modern engines, thus avoiding the danger of piston seizure.

And their low factor of expansion permits smaller clearances and prevents piston slap.

In a word, they have all the merits of cast iron pistons with none of their defects.

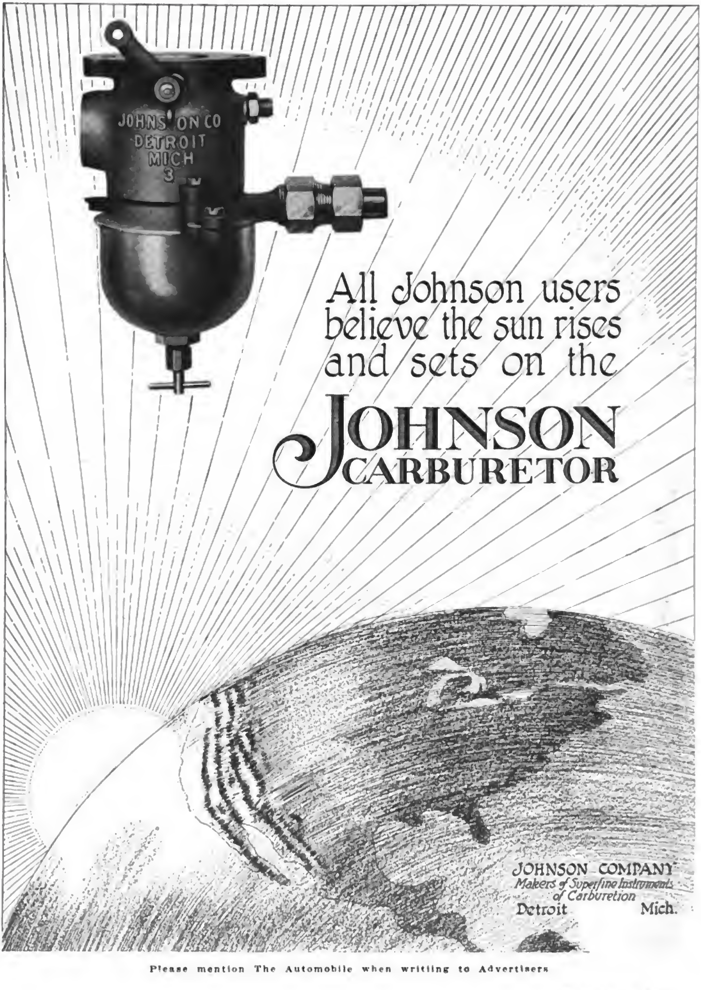
USERS

The adoption of Lynite Pistons by these well-known manufacturers has followed the severest tests of laboratory and road service.

Chalmers Motor Company
Chevrolet Motor Company
Cole Motor Car Company
Jas. Cunningham, Son & Co.
Curtiss Aëroplane & Motor Corp.
The Haynes Automobile Co.
Mercer Automobile Company
Nordyke and Marmon Co.
Oakland Motor Company
Olds Motor Works
Packard Motor Car Company
Premier Motor Corporation
Scripps-Booth Company
Sterling Motor Company
The White Company
Wisconsin Motor Mfg. Co.

The Aluminum Castings Co.
Cleveland, Ohio

PISTONS


JOHNSON CO
DETROIT
MICH
3
All Johnson users believe the sun rises and sets on the
JOHNSON
CARBURETOR
JOHNSON COMPANY
Makers of Superfine Instruments of Carburetion
Detroit Mich.

L. J. MUTTY CO
BOSTON
REGISTERED TRADE MARK

Everlastingly Keeping at One Thing Produces Results—

On this principle we have always specialized in just one thing, and that is combining rubber with fabrics.

Together with this specialty we have a hobby, and that hobby is QUALITY.

We produce rubberized fabrics for Automobile Tops, Curtains and Upholstery in several qualities, but our best effort which gratifies our hobby is known by the trade at large as BULL DOG QUALITY.

If you need rubberized fabrics in the manufacture of your products—investigate BULL DOG QUALITY.

Samples and prices on request.

L. J. MUTTY COMPANY, Boston, Mass.

Definite Cooperation

Let's go over the plan together. We figure that we should count as sales only the Old Sol Spotlights you sell—in other words when you get your allotment of the OLD SOL NITROJECTOR No. 100 and the Spotlights No. 70 and No. 77 we keep right with you with definite selling helps. This cooperation has been planned with the same skill that gave the Old Sol line its sales producing leadership.

OLD SOL

NITROJECTOR No 100

THE 100% PERFECT SPOTLIGHT

No matter what windshield lamp the car owner buys at first he will eventually get an OLD SOL NITROJECTOR No. 100. We know it is the best light that can be made answering all purposes and complying with every law for a no-glare lighting device.

We have planned a mammoth advertising drive—nation wide in its scope and volume—in full page and two page spreads.

We will link you up with this selling force. We will give you selling helps to use in your store. Handsome lithographed display stands will be sent you from your Jobber—booklets will be supplied in generous quantity with your name imprinted. Your Jobber will be ready at all times to offer you timely and definite advice and merchandising plans.

For Old Sol Dealers

This Display Stand is silent salesman for the Nitrojector Model 100—given free to Dealers with initial order of Nitrojectors.

This Silent Salesman

invites the attention of everyone who visits your store. On your showcase or in your show window it will make many a sale. It displays the OLD SOL NITROJECTOR No. 100. Made of metal, has handsome, lithographed, colored illustrations of the general uses of the spotlights. On the counter side are full selling directions for your salesmen. This will be supplied you free with your initial order. Tell your Jobber you want it.

This is a page from a Jobber's catalogue showing the value the Jobbers place upon the OLD SOL SPOTLIGHT as a selling proposition.

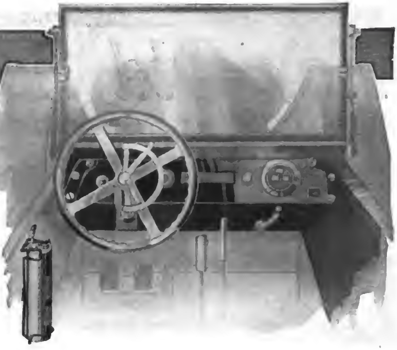
These catalogs will tell what you want to know about the line. Look for them.

Booklets too! Yes indeed, a generous supply free to you. Tell your Jobber how many you can use. Your name and suitable business announcement will be imprinted on them. Ask for the NITROJECTOR No. 100 booklet and for the OLD SOL SPOTLIGHT booklet. Two of them. Each four pages illustrated with fine photographs tells motorists what they want to know about spotlights in an interesting sales-producing way.

Get that letter off to your Jobber to-day.

HAWTHORNE MANUFACTURING CO., INC.
BRIDGEPORT, CONNECTICUT, U. S. A.
Makers of Old Sol Windshield Spotlights and Electric Lighting Devices.

You Need This Fire Protector Too!



HAVE you ever thought just what you would do if a fire broke out in your car? Your car and the *gasoline* carried in it both make good fuel for a blaze. Wise drivers have prepared for this. They believe in *fire protection.*

FYR FYTER
THE EXTINGUISHER
TO OPERATE TURN HANDLE AND PUMP
The Fyr-Fyter Company Dayton Ohio U.S.A.
FYR FYTER

Don't let fire catch you unawares. It's an unnecessary risk to take and certainly an expensive one. Because you have *had* no need for fire protection does not mean you will never have need for a Fyr-Fyter. Remember—fire gives no warning—it usually strikes when least expected.

MOTORISTS AGREE ON FYR-FYTER SUPERIORITY

Fyr-Fyter pump handle works both ways, eliminating confusion — extinguisher delivers a continuous, swift, death-to-fire stream. Fyr-Fyter pumps easily—so simple a child can operate it. Rough handling or a dent in the side *cannot put Fyr-Fyter out of commission. Approved by Underwriter's Laboratories. Fyr-Fyter saves 15 per cent on automobile fire insurance.*

Fyr-Fyters are put up in individual sealed cartons with bracket for attaching to motor car, garage wall or in the house. Made in four standard finishes, Polished Brass, Brushed Brass, Polished Nickel, Plated Brass and Gun-Metal.

Get on the safe side—see your auto accessory dealer today. Attach Fyr-Fyter to any convenient place in the car. It's small and out of the way, but it's always ready for instant service. Gasoline fires, electric short circuits, in fact any kind of incipient blazes are immediately extinguished. See your dealer today—insist on Fyr-Fyter.

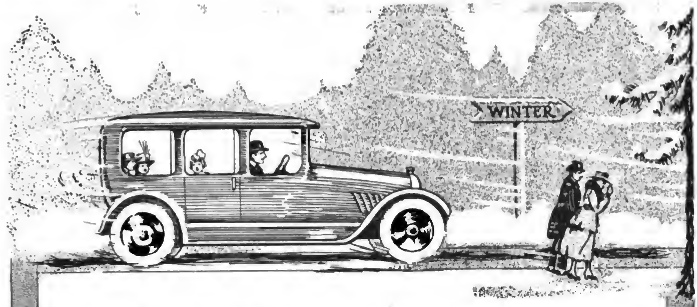
Dealers—to protect the territory you desire we advise you to write or wire us immediately. Fyr-Fyter superiority has caused men to act quickly. Don't lose the territory you want by delay. Write or wire now for complete sales plan, etc.

THE FYR-FYTER CO.
DAYTON, OHIO

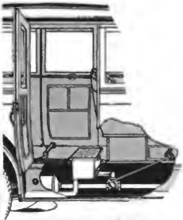
(17)

F

Fyr-Fyter
NEVER FAILS



You Can't Get Away from Winter but You Can Be Ready to Meet It—And Keep Warm—When It Comes



The Blackwell Auto Exhaust Heater Installed

Seven months out of every twelve you are driving in cold weather—and the rest of the time you are driving straight to meet it.

You can no more dodge winter, with its freezing blasts and zero days, than you can freeze water in the glare of the July sun—

But when the cold days come—and they will be here before you realize it—you can be as warm and comfortable in your car as you are at home, if you—

Tell Your Garageman Today to Install the

—BLACKWELL—
AUTO-EXHAUST-HEATER

Heats any car—large or small—with a current of **clean, warmed air.** A neat register, **level with the floor,** transmits the heat from air circulation chamber to the car.

Welded Throughout—Not Riveted—Absolutely Fume Proof

Clean outside air circulates in ⅜" asbestos lined duct, surrounding inside chamber of red hot gases direct from the exhaust pipe. Welded steel walls prevent intermingling of exhaust gas and heating air. Steel partitions in inner chamber circulate hot gases 3 times the length of the heater—6 feet in all—insuring sufficient heating area to keep the largest car warm in zero weather.

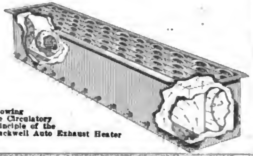
The warmest nights are already too cold for driving without artificial heat. The days will soon be as bad. The BLACKWELL Auto Exhaust Heater is a necessity 7 out of every 12 months. Have yours installed now, and use it for all it's worth.

RETAIL PRICE, $15.00

ASK YOUR DEALER today, or **WRITE US DIRECT**

DEALERS—BLACKWELL Auto Exhaust Heater is a big winter business booster. Seasonable NOW. Write or wire for discounts and details.

DAYTON WELDING COMPANY
DAYTON, OHIO



Showing the Circulatory Principle of the Blackwell Auto Exhaust Heater

Interchangeable—

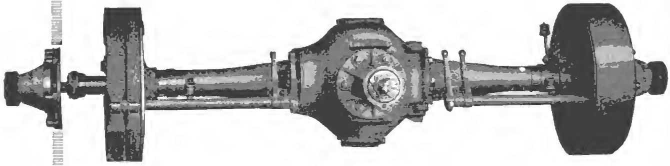
American Axles

for Wire or Artillery Wheels

WE can furnish this "**American**" Axle with Driving Flanges or Inner Hubs for Artillery Wheels, Houk Wire Wheels or Hayes Wire Wheels. Such Inner Hubs must be specified.

This Axle embodies the latest "**American**" improvements including pressed steel brake shoes; wide service brakes and narrow emergency brakes; full floating features; Bock taper roller bearings:—

Less Weight and Greatest Possible Efficiency



Licensed under The Kardo Company Patents

The American Ball-Bearing Co.

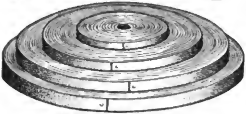
Pioneer Axle Builders of America **Cleveland, Ohio**

Write for samples of these good fan belts

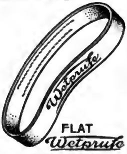
Wetprufe STITCHED FAN BELT

SOLID V FAN BELT

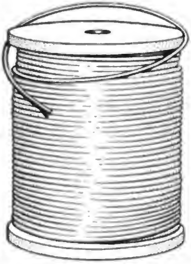
FLEXO "V" BELT



FLAT FAN BELTING



FLAT Wetprufe AUTO FAN BELT



ROUND FAN BELTING

Here's a line of automobile fan belts that meets the highest requirements of durability and service.

Solid "V" Belt—Made with or without lugs. Accurately cut to angle and size. Flexible, strong and practically stretchless. Dependable deliveries guaranteed.

Flexo "V" Belt—Designed for running on grooved pulleys. Laminated, each lamination overlapping the other. Very pliable and practically stretchless.

Wetprufe **Flat Fan Belt**—Used by many leading car builders and guaranteed to withstand water, heat and oil.

Wetprufe **Stitched Fan Belt**—Very flexible. Two-ply, triple stitched.

Round Fan Belting—For fans and other light drives. In spools of 100, 200 and 500 feet. All sizes from ⅛ to ½ inch.

Flat Fan Belting—In rolls. Absolutely water proof, heat proof and oil proof. Can be cut to any desired length and made endless with a flexible fastener, which we furnish. Unless otherwise ordered, laps will be stitched with two rows of strong linen thread.

Write for samples and prices of any or all these dependable belts

DEALERS!

75 per cent of the leather parts used in the manufacture of automobiles today is furnished by this company. Leather parts that for years have met the rigid

DEALERS!

tests of car makers and their engineers are sure to satisfy your customers. Write for our profit-making proposition.

HIDE, LEATHER & BELTING CO.

227B South Meridian Street
INDIANAPOLIS : : : : : : INDIANA

Detroit Office: 406 Kerr Building
W. C. DuCOMB, Jr., Special Representative

THE AUTOMOBILE
239 WEST THIRTY-NINTH STREET
NEW YORK CITY

The Gift

If suggestions are in order, may we say--THE AUTOMOBILE would be an appropriate gift. Your car owner friend would not only receive on Christmas the accompanying certificate (illustrated) and the Christmas number, but also a copy of THE AUTOMOBILE each week throughout the year 1917.

A more practical, interesting and lasting reminder of your friendship and interest can hardly be thought of--yet, at the same time, the expenditure is small--$3.00 for each subscription.

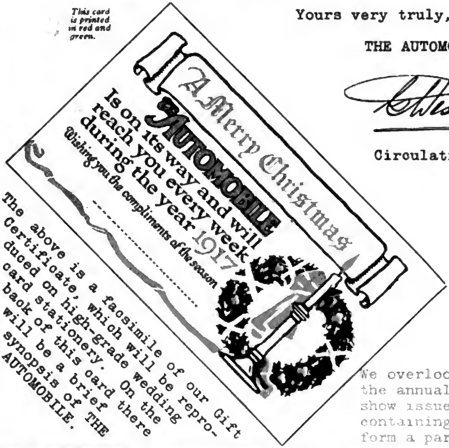
Trusting our suggestion will prove timely, and that we may have the pleasure of serving many of your friends during 1917, with greetings, we are,

Yours very truly,

THE AUTOMOBILE,

Circulation Manager

This card is printed in red and green.



A Merry Christmas

THE AUTOMOBILE

Is on its way and will reach you every week during the year 1917

Wishing you the compliments of the season

The above is a facsimile of our Gift Certificate, which will be reproduced on high-grade wedding card stationery. On the back of this card there will be a brief synopsis of THE AUTOMOBILE.

We overlooked mentioning that the annual twenty-five cent show issue of THE AUTOMOBILE, containing over 250 pages, will form a part of each subscription.

"A Car That Will Out-perform Any Other in Its Price-class"

After all, performance is the most jealously prized motor car attribute.

And when you come to seek the reason for the overwhelming success of Saxon "Six" you'll find it, most likely, in its ability to out-perform any other in its field.

Since the first Saxon "Six" went into service some two years back it has been passing through a constant state of development.

Uniform torque—perfect power-flow—was the standard sought and now attained.

Each explosion merges into the next—with no interval interposing to produce the vibration that shortens the life and impairs the efficiency of less able motors.

Consider, for instance, a comparative case if you would know how surprisingly Saxon "Six" surpasses any other at less than $1200.

Running one of the best known cars of less than six cylinders at 20 miles per hour, there are 1512.73 power impulses per minute.

Running Saxon "Six"—under the same conditions—at 20 miles per hour, there are 2993.925 power impulses per minute.

That is to say Saxon "Six" produces 97.9% more impulses per minute at a 20 mile per hour speed than this well-known car of "less-than-six-cylinders." This is practically perfect continuity of power-flow.

Think how much less friction there is in the Saxon "Six" motor.

Think how much longer life this gives Saxon "Six," since friction is the greatest enemy to a motor's endurance.

Translated into dollars and cents, think how little will be your repair service cost on Saxon "Six" as compared to the car with less-than-six-cylinders.

You will find the super-ability of this Saxon "Six" motor reflected to your benefit in many ways.

First, in unusual quietness and smoothness. Engineers estimate the power-flow smoothness of Saxon "Six" to be nearly 98% greater than that of the "less-than-six."

Second, in astounding quickness of "pick-up"—from standing start to 45 miles per hour in 23 seconds.

This "less-than-six" we cite required 30 seconds in that test.

Third, in amazing flexibility. Seldom indeed, do Saxon "Six" owners resort to gear shifting.

Fourth, in unrivaled pulling power.

Saxon "Six" is $815 f.o.b. Detroit. (672)

SAXON "SIX"

A BIG TOURING CAR FOR FIVE PEOPLE

SAXON MOTOR CAR CORPORATION, Detroit

Attention to every detail of design and manufacture is the secret of successful ball bearings. In the manufacture of GURNEY Ball Bearings we have used every means available to secure a bearing accurate, durable and reliable in every part. The GURNEY is a ball bearing into which has been put all the refinement of modern engineering skill.

Our equipment and organization make it possible to assure you of prompt deliveries.

GURNEY BALL BEARING CO.
Conrad Patent Licensee
CHICAGO JAMESTOWN, NEW YORK NEW YORK CITY

MICHELIN

For Your Own Best Interests Mr. Dealer We Repeat:

"INVESTIGATE THE MICHELIN PROPOSITION FOR 1917 NOW."

You will profit by it.

You will increase your sales—not only of tires but of all things you sell.

You will reduce your selling costs and increase your net profits.

Michelin says you will, and Michelin's reputation is as old as the tire industry itself.

Not only do we give you the agency for a tire of "Quality unsurpassed but NOT high in price"—

But, in Addition

We offer you this thoroughly-thought-out and successfully demonstrated plan to expand *your whole business.*

Why?

Because we want *successful* dealers representing us; dealers that radiate prosperity.

Such dealers will sell the most Michelins and sell them to prosperous customers, to the best and steadiest customers.

Therefore, we figure that it is to our own interest to aid your prosperity.

NOTICE THE CURVE

THIS is no Santa Claus proposition; what we give you we expect to get back—we know from experience we *will* get it back.

We know from experience that the *surest* way to get it back—with interest—is to get *you* interested in it—make it worth something to you.

So we offer you the best proposition from *your* standpoint that has ever been offered to any dealers.

We have it here—completely arranged—every detail thought out—ready to hand you.

It certainly is up to your business sense to grasp the big opportunity thus held out to you—

And to do it NOW—TODAY!

MICHELIN TIRE COMPANY
Milltown - - - New Jersey

The time for you dealers who have been interested in reading this advertisement to get in touch with Michelin is right now.

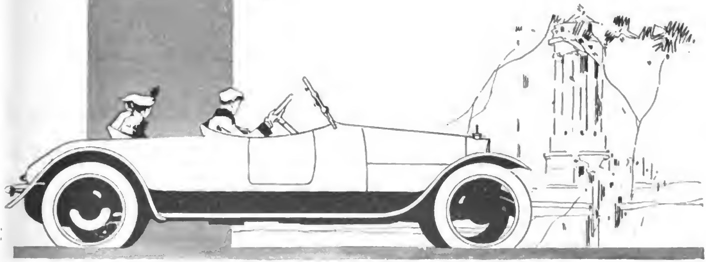
Don't bother to write letters; just send a wire that you want information regarding this plan, and same will be sent to you at once. Or if you are ready to do business immediately, ask to have a Michelin representative call and he will get on the first train he can catch.

DO you realize that at times your car is enduring 5400 explosive impulses of terrific force, delivered every minute through the gears and transmission to the rear axle, to the tires, to the point of road contact? Do you realize that these terrific impacts are gradually beating your car to death?

Do you realize that the Owen Magnetic STAYS YOUNG because it is NOT beaten to death this way?

You are told HOW and WHY in the Dec. 28 issue of this magazine, in a comprehensive four page story superbly illustrated. Watch for it. Better still, let us send you a personal copy of this story with our compliments. A card will bring it.

Baker R&L Company
CLEVELAND OHIO
Manufacturers of
Owen Magnetic Motor Cars
Salesrooms
New York-Boston-Philadelphia-Chicago



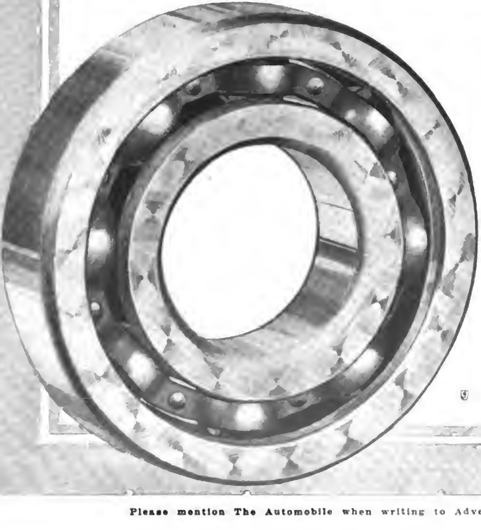
THIS ENORMOUS, MODERN EQUIPPED, NEW PLANT IS YOUR ASSURANCE BOTH OF QUALITY PRODUCTION AND FAITHFUL ADHERENCE TO DELIVERY SCHEDULES.

¶ It is important first to remember in connection with U. S. Ball Bearings that only quality bearings are produced in this immense plant—one of the largest exclusive ball bearing plants in the world. This is positive assurance that every user of U. S. Ball Bearings receives only one quality bearing—the highest possible of production—for that is the only kind of U. S. Ball Bearings produced.

¶ Of next importance is the fact that deliveries are never promised unless they can be lived up to faithfully. In other words, while our production is great—upwards of 10,000 quality bearings per day—our facilities are such as to enable us to maintain our delivery promises as well as to maintain the quality of the product itself.

¶ And when we speak of quality bearings we mean quality not only of materials used and manufacturing methods employed but of design as well. Each component of every bearing is designed in perfect relation to every other component so that the result is a perfectly balanced bearing—a bearing in which the capacity of the raceways is in absolute balance with the capacity of the balls.

¶ In other words in the U. S. Ball Bearing you find the most highly developed and most efficient ball bearing known to the manufacturing world—hence the most efficient anti-friction device obtainable.



U. S. BALL BE

Conrad

Palmer Street and Ke

U.S. BALL BEARINGS

BALL BEARINGS offer least friction to the transmission of power.

BALL BEARINGS offer exceptionally great carrying capacity.

BALL BEARINGS wear longest.

BALL BEARINGS have won every racing classic.

BALL BEARINGS are used by practically every foreign manufacturer.

BALL BEARINGS are always found where efficiency dominates cost.

ARING MFG. CO.
Patent Licensee
mar Avenue CHICAGO, ILL.

Why the Stars?

Protected Territory
for
STAR Dealers

Are you just swapping dollars with tire manufacturers or are you building a permanent business with continuous profit?

If you are ready to accept the EXCLUSIVE agency for the newest STAR in Tiredom, write us immediately.

Why the stars? Count them—we offer to 49 responsible dealers an opportunity for putting unlimited effort behind their sales—receiving in return **absolute territorial protection.**

A bright new STAR has appeared in the tire world. Akron's most experienced capital—and plenty of it; its best manufacturing brains (our production managers have had 20 years experience); and a determination to build a tire as it should be, merges into a perfect unit that guarantees the greatest ultimate and profitable success ever presented to tire distributors..

A full line of clincher, quick detachable clincher and straight side STAR tires will be made. The Silver Star and Red Star tubes will be of laminated construction and of extraordinary quality. 5,000 miles guaranteed service.

There will be no branches but entire output
will be sold through exclusive agencies.

Quick action necessary to secure your territory.

THE STAR RUBBER CO.
DEPT. 2
AKRON, OHIO

HAND-MADE
TIRES

New York Auto Show Exhibit—Hotel Astor
Chicago Auto Show Exhibit—Auditorium Hotel

Celfor

Internal Gear Drive Axle

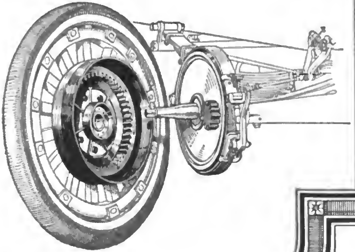
TWELVE TALKS TO ENGINEERS

Talk No. 6—Driving Near the Rim

Any engineer knows well the advantage of supplying the driving power to wheels near their peripheries rather than at their centers. Truck wheels can scarcely be built too strong to withstand the severe service to which they are subjected. Is it not better to give them every chance? When you drive the wheel near the rim you operate it under the most favorable conditions. This is better not only for the axle but also for the wheel.

This is one of a series of twelve engineering arguments. If you would like to have the whole set at once, write to the

Celfor Tool Company
Buchanan, Michigan



Specialists in the manufacture of both straight face and hour glass type worm gear.

BAUSH

WORM DRIVE

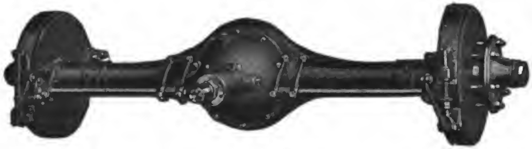
We are also manufacturers of Multiple Spindle Drills, Lassiter Stay Bolt and Bolt Turning Machines

BAUSH
MACHINE
TOOL CO.
Springfield,
Mass.

Traffic Demands

THE Traffic Demands of today impose strains on motor car axles that were unheard of a few years ago. Multiple cylinder motors send a stream of power coursing through the rear axle that necessitates the greatest degree of strength. And with this, modern motor car building demands the elimination of every ounce of superfluous weight.

Columbia Axles are lighter in weight than other types, yet they are stronger. Pressed-steel housings and three-quarter floating type construction are both responsible for the saving of weight possible in Columbia Rear Axle Construction. Maximum strength is attained through the re-inforcement of these housings by seamless drawn steel tubes.



Spiral bevel gears, taper roller bearings, internal and external wrapping type brakes are features of Columbia Axles concisely described in the Columbia booklet. A copy will be gladly sent at your request.

THE COLUMBIA AXLE COMPANY, CLEVELAND, OHIO

COLUMBIA

AXLES

Firestone

The Modern Atlas

TO carry the burdens of the world, and to carry them with the maximum of strength, comfort and low cost, this is the Firestone part in today's affairs.

Whether on pleasure car or truck, motor cycle or bicycle, Firestone Tire quality, in design and rubber, fabric and workmanship, is the quality which upholds the present high standard in transportation.

The world moves faster, better and cheaper because so large a part of it rides on Firestones. Equip all around, today. Your dealer will take care of you.

FIRESTONE TIRE & RUBBER COMPANY
Akron, Ohio—Branches and Dealers Everywhere

MOTOR PRODUCTS CORPORATION

FIVE BIG COMPANIES REORGANIZED AS ONE

In the Motor Products Corporation of Detroit continues the business of the Diamond Manufacturing Company, the Rands Manufacturing Company, the Vanguard Manufacturing Company, the Superior Manufacturing Company and the Universal Metal Company—all formerly well and favorably known concerns in their respective lines.

We believe the Motor Products Corporation stands as a particularly unique organization in the history of automobile building, for at no time before has a number of healthy and growing parts concerns reorganized into one big active manufacturing company. Furthermore, we believe the Motor Products Corporation is an organization of great importance to automobile and truck manufacturers, because of the increased economies of production and the betterment of service to customers effected through conducting manufacturing operations in one large unit, under one centralized management.

The Motor Products Corporation is continuing to manufacture the same high quality products formerly marketed by the constituent companies—hub caps, radiator parts, wind-shields, tubing and other accessories—in its huge new Detroit factory. Branch factories are located at Ann Arbor, Mich., and Walkerville, Ont.

MOTOR PRODUCTS CORPORATION

DETROIT, MICHIGAN

W. C. Rands
President

H. H. Seeley
Vice-Pres. and
Director of Sales

D. B. Lee
Treasurer and Gen'l Mgr

C. F. Jensen
Vice-Pres. and
Director of Purchases

R. R. Seeley
Production Manager

M. L. Brown
Secretary

Successors to

Rands Mfg. Co.
Superior Mfg. Co.
Vanguard Mfg. Co.
Diamond Mfg. Co.
Universal Metal Co.

THE NATIONAL AUTOMOBILE SHOWS

are of tremendous importance to every advertiser. The industry's three leading papers enable advertisers to "cover the shows" to maximum advantage—at minimum expense

The Automobile *Motor Age*
Motor World

COMBINED CIRCULATION IN EXCESS OF

75,000

IMPRESSIONS received during Show time have a peculiar permanency. ¶ Show season is without question one of the best times in the year for publicity advertising. It is a time when publicity advertising is good for firms who at other seasons of the year think of advertising only as a means to secure immediate results. ¶ It is the time of all times for creating good will, and for securing prestige. ¶ Prestige and good will constitute a tremendous asset, not measurable in dollars and cents. ¶ During the show season engineers and manufacturers are focusing their attention upon structural units. ¶ Dealers are carefully studying merchandise lines. ¶ Car buyers are scrutinizing every intelligent and logical claim that is presented by the manufacturers. ¶ Accessory buyers have an intensified interest in every article of merit. ¶ These distinct divisions of interest depend upon class papers to render them a distinct and authoritative service. We serve each division of interest with a paper that specializes in that particular field of reader interest.

In order that this service may be complete The Class Journal Co. publishes three papers, each serving a distinct reader clientele, as follows:

THE AUTOMOBILE

An authoritative guide for engineers, manufacturers, purchasing agents, and a large group of car owners in all parts of the country—men who are in the graduate class insofar as knowledge of automobile mechanics is concerned.

MOTOR AGE

Presents the popular phases of motoring—racing, touring, new car and accessory descriptions, etc. The most widely read of the several papers that serve the industry.

MOTOR WORLD

Designed and edited for the merchandising and maintenance branches. Its substantial reader clientele buys at wholesale and sells at retail a big percentage of all products of the automobile and accessory industry.

THE SHOW ISSUES

The annual Automobile Show issues of these three papers have become an institution. Combined circulation more than 75,000 copies. Editorial contents of a very special nature render them of unusual value to the industry, to the trade and to motorists generally.

They are re-read and kept as reference guides, in many cases, during the entire year.

If you haven't planned and given instructions covering copy and cuts for insertion in our forthcoming special show issues please give the matter attention at once. We have exceptionally good copy service departments in both our New York and Chicago offices. Possibly we can help with your copy. An opportunity to do so would be welcomed. We make no charge for copy writing, and charge only nominally for art work and making cuts.

Here is the list of special issue dates, and a brief summary of editorial contents:

THE AUTOMOBILE

New York Show Issue

January 4th

Chicago Show Issue

January 25th

EDITORIAL CONTENTS

An engineering analysis of all the U. S. A. automobiles, in which 1917 design is contrasted with the design of 1916 and previous years. Will be a summation par excellence of over 100 different models of 1917 mould. This analysis will be illustrated with those high spots of engineering which characterize the year. Supplementing this will be a graphic color chart showing the trend of design based on annual mechanical specifications of over one hundred and twenty 1917 models in contrast with similar specifications ranging over a period of six years. This will be a graphic history of how design has given away to design and how engineers have built stone upon stone the present structure of automobile engineering. Supplementing this will be many engineering stories closely related with the 1917 automobile.

MOTOR WORLD

DEALERS, JOBBERS AND GARAGEMEN

Before Show Issue (New York)

December 27th

Before Show Issue (Chicago)

January 17th

EDITORIAL CONTENTS

From front to back cover every story, every picture, every paragraph and every sentence will be published with the dealer, the garageman, and the jobber in mind. The complete message will be for this great triumvirate of the motor car merchandising and maintenance field. Engineering stories to help salesmen sell cars will fill a long-felt want. What are the engineering arguments in a car?—the very warp and woof of the salesmen's arguments. Many salesmen have never known the why's and wherefore's of a cantilever spring, a V motor, an overhead camshaft, a tulip valve, Hotchkiss drive, etc. Maintenance arguments on cars are potential to salesmen. Can you pick out the ten best features in the car you are selling that make it cheap to maintain? To this will be added a story on each car, mechanical specifications, car pictures, and hundreds of other features of interest.

MOTOR AGE

New York Show Issue

January 4th

Chicago Show Issue

January 25th

EDITORIAL CONTENTS

This great motor journal of international reputation will present the greatest and most complete illustrated department of 1917 cars ever printed. Thirty-two complete pages will show cars of many models from 150 or more different makers—five-passenger touring cars, seven-passenger cars, coupes, sedans, convertibles, limousines, landaulets, broughams—all styles segregated and with name, model, price, passenger capacity and many other facts the owner wants to know. Added to this will be many pages of complete tables giving every mechanical detail of the cars. For the reader who wants to know what each maker has done during the year there will be a car-by-car story of the improvements made, new models brought out, new color schemes, etc. This car-by-car review will bring you right on to the doorstep of January 1 and will contrast past practice with present achievements.

Copy should be in our hands one week before dates of issue. ¶ Send Motor Age copy to our Chicago office and copy for The Automobile and Motor World direct to our New York office.

THE CLASS JOURNAL COMPANY

239 West 39th St., New York City Mallers Building, Chicago

PITTSFIELD DISTRIBUTOR

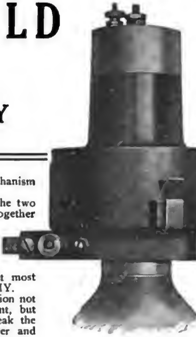


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Fig. 1

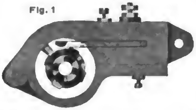


Fig. 2

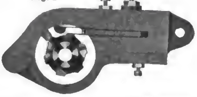
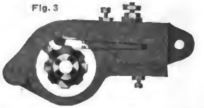


Fig. 3



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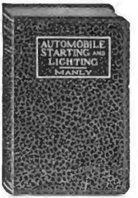

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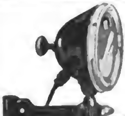

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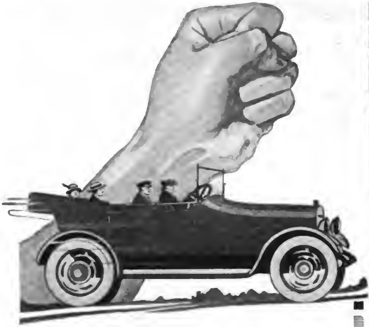

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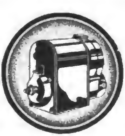

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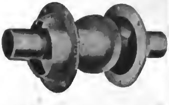

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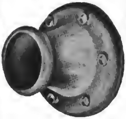

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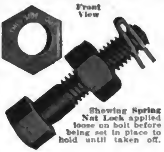

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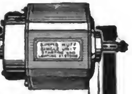

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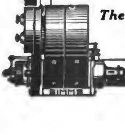

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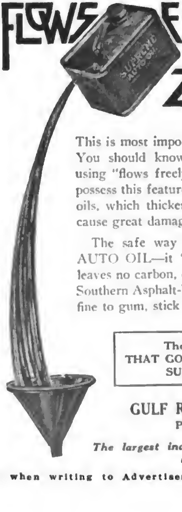

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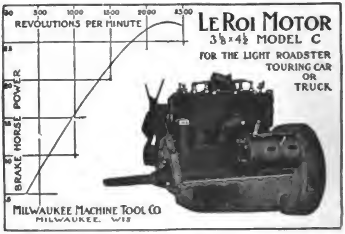

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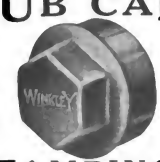

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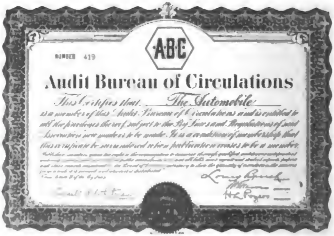

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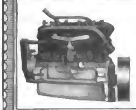

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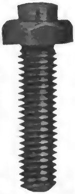

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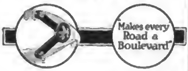

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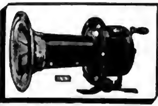

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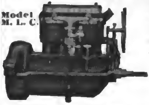

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A precision instrument giving permanently, exact carburetion for your car.

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NON-FLUID OIL gives perfect protection against friction even in zero weather. That's *more* than can be said about common grease.

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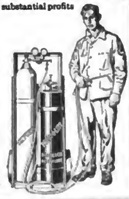

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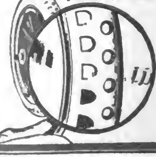
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Ferrule Clip furnished in Thrust form, Hook form and Short Clip form, to fit any wire up to ½" in diameter.

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Primary with ferrules same as Ferrule Clip.

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You can find a Columbia model at your dealer's between the prices of $15 and $350 that will make an ideal and splendid Christmas gift—the *most* in music at the price you wish to pay. Call on your Columbia dealer *quick* and reserve the instrument you want *today*.

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Suppose your lights went out suddenly, without warning, on a black night, with a bad road. Don't chance it. Put a

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They follow closely the lines of the preceding series, and the only changes are in the nature of refinements.

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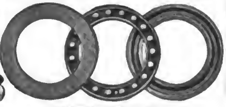

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COMPLETE THRUST BEARING

MADE IN AMERICA

Manufacturers of Star Radial Ball Retainers, Star Ball Thrust Retainers, Star Complete Ball Thrust Bearings

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Do you turn away business because you don't know where to get these parts—

Or are you afraid the price will stun the customer?

Now listen—

Get on the inside of the Puritan—make it your business to know what we can do—we want you to know—that's why we are hammering at you now—

We've over 2,000,000 parts and sell them for prices that make orders easy if you'll just get us to quote.

These are only a few stray ones. Write us if you don't see what you want.

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Puritan Machine Company

ALL PARTS FOR ALL CARS
408 Lafayette Blvd.
Detroit, U. S. A.

See our other ad on page 95.

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We Pay the Express

only when payment in full accompanies order; otherwise send $1 deposit, bal. C. O. D., subject to inspection.

Our Tires Are So Good

that, if on examination you are dissatisfied, ship them back and we will refund full amount immediately.

3500 Mile Guarantee Tires and Tubes

Fresh Selected Stock—Standard Makes at prices you can't afford to overlook.

Size	New Tires	New Tubes
28x3	$6.00	$1.50
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30x3½	8.00	2.25
31x3½	8.50	2.50
32x3½	9.00	2.50
34x3½	9.50	2.55
36x3½	10.75	2.75
31x4	11.75	2.90
32x4	12.50	3.20
33x4	12.75	3.25
34x4	13.25	3.35
35x4	13.50	3.45
36x4	14.00	3.50
34x4½	16.25	4.00
35x4½	17.00	4.15
36x4½	17.50	4.25
37x4½	18.00	4.35
35x5	17.50	5.00
36x5	18.50	5.00
37x5	20.00	5.20

Add 10% to the above prices for non-skid

Special Bargains in Slightly Used and Demonstrating Tires

Size	Used Tires	Used Tubes
30x3	$3.50	$1.35
30x3½	4.25	1.45
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32x3½	5.25	1.50
34x3½	5.50	1.60
31x4	6.25	1.65
32x4	7.00	1.60
33x4	7.25	1.70
34x4	7.75	1.70
35x4	7.50	1.75
36x4	7.50	1.75
34x4½	8.00	1.75
35x4½	8.00	1.80
36x4½	8.25	1.85
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35x5	8.50	2.00
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We guarantee all tires sold by us at the above prices to be free from imperfections in material and workmanship.

SPECIFY STYLE OF RIM
TO AVOID DELAY

Tire Repair & Supply Co.

INCORPORATED
1463 Michigan Ave., Chicago, Ill.

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Buick Model F	32.50	Hudson 54, 1914	39.00
Buick Model F, 1910	32.50	Imperial 34	43.00
Buick Model D	32.50	Maxwell Mascot	33.50
Buick Model 35	30.00	Midland 1913	38.00
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Prices quoted for all makes of cars.

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Our Repair Department turns out excellent work at low prices.

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Auto Parts

We have in stock, ready to meet your wants, Pistons, Axles, Cylinders, Magnetos, Motors, Lamps and everything in the auto line at

One-Half the Manufacturer's Price

We sell only parts that are serviceable and if our parts are unsatisfactory, we will cheerfully refund your money.

Our list of satisfied customers is rapidly growing larger and this is the result of our better service methods. We can fill your order and ship to you in less than four hours.

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Largest Auto Part Dealers in the Country

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Write for the Puritan Bargain Bulletin.

Puritan Machine Company
ALL PARTS FOR ALL CARS
408 Lafayette Blvd. Detroit, Mich.

See our other ad page 94.

AUTO REPAIR PARTS
50% TO 75% OFF

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Overland, Warren 30
Moon 30-40-45, Peerless 1906 to 1913
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Cadillac 1909 to 1913
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138 COMPLETE MOTORS, 4 and 6 Cyl. Tested and in good running condition. $35 to $175.

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2500 AUTO WHEELS $2 to $7.

8000 GOOD AUTO SPRINGS $2 to $5.

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NO SECOND-HAND PARTS OR JUNK
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In Fact, Everything for the Automobile

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We have them for most any make car. We save you 50% to 75%.

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Send for our list describing them

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We Tear 'em up and sell the Pieces.
13th & Oak Kansas City, Mo.

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including timer, coil and switch for Maxwells, Chevrolets and Dort cars, $6.00.
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Don't Waste It

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285-287 Morris Ave., N. Y. City,
Near 138th St. and 3rd Ave.

MY PRICES ARE RIGHT

We have second-hand motors for every make of car for $25.00 and up.
We also carry a complete line of
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Crank Shafts @ $10.00 each
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No matter what you need, let us quote you a price that will save you from 25% to 50%.
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ALL REPAIR PARTS FOR OLD cars on hand for immediate shipment. Gears, complete Cylinders, Rear Axles, Transmissions, Carburetors and Magnetos. Write us first.
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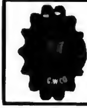
J. FILLMORE COX
ENGINEERING & TUBE BENDING MACHINE WORKS
BAYONNE, NEW JERSEY



CULLMAN
Sprockets and Differentials
In stock and to order. Send for Catalog.
CULLMAN WHEEL COMPANY
1347 Altgeld Street, Chicago

WONDER-MIST

For Cleaning Automobile Bodies

Garagemen find it cheaper to use than soap and water—cheaper and infinitely more satisfactory to their customers.

THE WONDER-MIST CO.
General Offices, 14 Federal St., Boston, Mass.
New York Office, 1780 Broadway.
Chicago Office, 162 No. Dearborn St.

COUNTERBALANCED
PARK
CRANK
SHAFTS

Patent Applied For

The
PARK
DROP
FORGE
CO.

CLEVELAND, OHIO

THE MARK OF A BETTER RADIATOR

QUALITY
RADIATORS
FOR
PLEASURE CAR
AND
HEAVY DUTY SERVICE

G & O MFG. CO.
NEW HAVEN CONN.

Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

Aluminum Casting Co. 56-57
American Ball Bearing Co. 64
American Bronze Company 53
American Sheet Tin Plate Co. 99
Atwater Kent Manufacturing Works 89

B

Baker R & L Co. 71
Baush Machine Tool Co. 76
Bearing Co. of America 93
Beaver Mfg. Co. 91
Bosch Magneto Co. 92
Bossert Co. 84
Braender Rubber & Tire Co. 89
Brown-Lipe-Chapin Co. 89

C

C & C Sales Corp. 101
Celfor Tool Company 75
Central Steel Company 102
Champion Ignition Co. 85
Cincinnati Storage Battery Co. 88
Columbia Axle Co. 77
Columbia Graphophone Co. 93
Columbus Varnish Co., The 86
Continental Motor Co. Front Cover
Corcoran-Victor Co. 92
Cullman Wheel Co. 99

D

Dayton Top Improvement Co. 83
Dayton Welding Co. 63
Dover Stamping & Mfg. Co. 101
Drake & Co., F. J. 82
Durston Gear Company 88
Dyneto Electric Co. 92

E

Eclipse Machine Co. 89
Edmunds & Jones Corp. 92
Eisemann Magneto Company 84
Electric Auto-Lite Co. 93
Electro Metal Products Co. 89
Engineering & Tube Bending Works 99

F

Fahrig Metal Co. 90
Firestone Tire & Rubber Co. 78
Foster Accessories Co., C. H. 83
Fyr-Fyter Co. 62

G

Gibson-Hollister Mfg. Co. 89
G-O Manufacturing Co. 100
Grossman Corp., Emil 91
Guaranty Securities Corp. 87
Gulf Refining Company 86
Gurney Ball Bearing Co. 68

H

Hartford, E. V., Inc. 91
Hawthorne Mfg. Co., Inc. 60-61
Hide Leather & Belting Co. 65
Houk Mfg. Co. 91
Hyatt Roller Bearing Co. 93

I

Indiana Rubber & Insulated Wire Co. 92

J

Johns-Manville Co., H. W. 55
Johnson Company 58
Johnson & Sons, S. C. 47

Index to Advertisers

K

K-W Ignition Co. 87
Kissel Motor Car Co. 54

L

Liberty Cut Glass Works 86
Liberty Motor Car Co. 90

M

Mercer Automobile Co. 93
Merrill Spring Co., E. R. 99
Michelin Tire Co. 69-70
Milwaukee Machine Tool Co. 88
Moltrup Steel Products Co. 91
Monroe Motors Co. 49 to 52
Motor Products Corp. 79
Motor World 90
Mutty Co., L. J. 59

N

National Equipment Co. 1
National Rubber Co. 90
New Departure Mfg. Co. 90
New Process Gear Corporation 88
N. J. Car Spring & Rubber Co. 92
N. Y. & N. J. Lubricant Co. 92

P

Park Drop Forge Co. 100
Perlman Rim Corp. 90
Pfau Mfg. Co. 87
Pittsfield Spark Coil Co. 82
Prest-O-Lite Co. 92

R

Rajah Auto Supply Co. 93
Rayfield Carburetor Co. 48
R. & H. Platinum Works 90

S

Salisbury Wheel & Mfg. Co. 90
Saxon Motor Car Corp. 67
Seiss Mfg. Co. 91
Sheldon Axle & Spring Co. 88
Simms Magneto Co. 85
Splitdorf Electrical Co. 84
Spring Nut Lock Company 85
Star Rubber Co. 74
Stewart-Warner Corp. 2nd Cover
Stromberg Motor Devices Co. 93
Studebaker Corp. 4
Sunderman Corporation 3rd Cover

U

U. S. Ball Bearing Co. 72-73

W

Wadsworth Mfg. Co. 88
Ward Leonard Electric Co. 91
Waukesha Motor Co. 89
Weston Electrical Instrument Co. 93
White & Bagley Co. 2
Whitney Mfg. Co. 87
Willys-Overland Co. Back Cover
Winkley Co. 88
Wondermist Co. 99
Woodstock Hotel 86
Wyman & Gordon Co. 3

Z

Zenith Carburetor Co. 91

DOVER
INDESTRUCTIBLE
HEADLIGHT BULB CARRIER
FOR
FORD
CARS

The Dover Indestructible Headlight Bulb Carrier solves the problem. It is a round metal container provided with socket at each end which holds the bulbs more securely than in the lamps themselves. Keep it in your tool kit, always ready when needed.
Saves annoyance and prevents accidents in night driving.

DOVER STAMPING & MFG. CO.
CAMBRIDGE, MASS.

PRICE 35¢

Carries 2 Electric Headlight Bulbs

BALL BEARINGS C&C STEEL BALLS

Ball Bearings

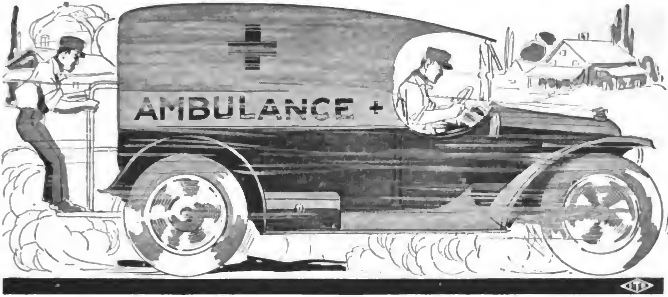
Steel Balls

Immediate Deliveries

WE are authorized Purchasing Agents in America for European Motor Car Builders.

Parts and accessory makers send us your catalog for ready reference.

C & C Sales Corporation
1765 Broadway New York



Emergency requires Speed!

Emergencies require speed and mean extraordinary strains. No matter what the condition of the roads, the driver must take advantage of the "short cuts".

Hitting the rough spots on high is dangerous business, unless the machine is built of the right materials.

Automobile and auto truck builders realize the great importance of right materials. More and more of them are specifying "AGATHON" STEELS—especially for AXLES; CRANK SHAFTS; DRIVE SHAFTS; CONNECTING RODS; TRANSMISSION GEARS, etc.

Let us tell you "Why".

AGATHON STEELS

"AGATHON" Chrome Nickel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steels
"AGATHON" Vanadium
"AGATHON" Chrome Steel
"AGATHON" High Carbon
"AGATHON" Special Analyses

The Central Steel Company

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J. E. Dockendorff & Co., 20 Broad St., New York, N. Y., General Export Agents

THE SUNDERMAN
VACUUM CARBURETOR
SHATTERS CARBURETOR TRADITIONS

OWNERS, designers and manufacturers of cars make a very simple demand on a carburetor—that it shall deliver an efficient mixture of gasoline and air, an instantaneously explosible gas, under all conditions of climate, atmosphere, elevation and temperature.

We believe carburetion engineers have been wrong in their efforts to attain this end. To look at the ordinary instrument one would know its designer was a *mechanical* engineer, but would suspect his proficiency in carburetion.

We believe so, because we have met the simple *demand* for carburetion by a simple *instrument* for carburetion—one that gives the required mixture under all conditions of service, that positively saves a large percentage of fuel, no matter what grade. It adds to the motor to which it may be attached elements of power, speed and flexibility that commend it as the best designed carburetor in the industry.

$5 $6.50 with elbow for attachment to engine where manifold is not cast in head. (Ford and Metz cars do not need elbow)

A Simple Instrument—Scientifically Exact—Unbelievably Economical

It has only 28 parts—or about ⅓ to ⅙ of the average.

It operates on the vacuum principle—to which all must come.

It has two jets—varying gasoline feed for varying speeds.

It has a screen that serves the double purpose of pulverizing the gasoline particles and preventing backfire.

It possesses a simplicity that is astonishing, and operates in an unbelievably economical manner.

And as a whole, it is an instrument that is to the ordinary carburetor what the expert is to the novice.

CAR OWNERS: Ask your dealer, or write us direct.
MANUFACTURERS: A better proposition cannot be imagined than that we offer on equipment business.
DEALERS: Big profits and good territory await the live merchant who will put his shoulder to the wheel. Ask us what we can do for you.

SUNDERMAN CORPORATION

3 CHAMBERS ST. NEWBURGH, N. Y.
WESTERN SALES OFFICE: 403 KRESGE BLDG., DETROIT

Willys SIX

Seven Passenger

$1325

f. o. b. Toledo

NOTABLE for Power and Pick-up at the Normal Driving Speeds

The Willys-Six, compared with any other six of its size, will give you

—higher power at normal driving speeds,

—faster pick-up at normal driving speeds,

—smoother climbing without rushing the hills,

—greater smoothness in high gear at very slow speeds.

The new Willys-Six attains a speed of 20 miles per hour at 768 r.p.m.—40 miles per hour at 1536 r.p.m.

In design, finish and appointments it is new, beautiful, complete and up to the minute.

It sets a new high mark in easy riding comfort.

Long forty-eight-inch cantilever rear springs, perfect balance, long wheelbase—125 inches, big tires—4½x35 inches—provide the utmost ease and luxury of riding comfort.

And the low, deep-cushioned seats are built over improved seat springs—each spiral separately encased and thus air cushioned and checked against rebound.

The price, $1325, is possible because Willys-Six shares the economies that we obtain by building a complete line of automobiles in our factory.

—with *one* executive organization,

—*one* purchasing power.

—and selling them with *one* sales expense through *one* dealer organization.

The Willys-Overland Automobiles represent an exceptional buying opportunity for the public—an exceptional selling opportunity for automobile dealers.

The Willys-Overland Company, Toledo, Ohio

Manufacturers of Overland and Willys-Knight Automobiles

"Made in U. S. A."

Stanford Library
SEP 17 1938
B

The AUTOMOBILE

Vol. XXXV
No. 26

NEW YORK, DECEMBER 28, 1916

Ten cents a copy
Three dollars a year

Maud L'Anphere Crook

Stanford University, Cal.

Are You Content to Remain the Dealer of the Second Choice Car?

We don't reproduce here an advertisement to car buyers. For our talks to users and to dealers are much alike on Hudson Super-Six. Why men buy it is exactly why other men should sell it.

Last year thousands of buyers had to take second choice because there were not enough Super-Sixes to go around. Were you one of the dealers who took care of this overflow? Then, too, the average automobile dealer is *through* in August. His profits stop. His business is at a standstill for several months.

Did Your Income Stop?

Did your income stop last summer or did you, like Hudson dealers, make a profit in September, in October and in November?

Super-Six deliveries to users in October and November exceeded any two months' previous records in our history.

The demand for the Super-Six increased—it did not drop off as your business probably did, when the normal "slack" season for automobile selling arrived. Then Hudson dealers were having their three best money-making months.

Reasons for this Remarkable Showing

The Super-Six motor, an exclusive Hudson feature, has increased motor efficiency 80%. No other car can use it. It is patented.

The Hudson Super-Six has won all worth-while records.

Across the continent from San Francisco to New York and back—6,972 miles in 10 days and 21 hours. All previous one way records were beaten—no other car ever attempted the round trip.

The fastest time up Pike's Peak against twenty competitors.

100 miles at the rate of 74.67 miles per hour.

1819 miles in 24 hours.

One mile at the rate of 102.53 miles per hour.

Now all this has made it EASY to sell the Hudson Super-Six.

If you must exert effort to sell every car you handle, your business can't be profitable. Prospects must come to you, otherwise your business is all hard work.

How to Become a Hudson Dealer

Not by merely answering this advertisement. No, we are not so free with the Hudson money-making franchise as that.

Now that our organization is so large, the unquestioned largest automobile distributing organization in the fine car field, we don't have so many opportunities. We are not satisfied just because a contract is made with someone to handle a certain territory.

It is more important that we know how that territory is to be handled and more than that what potential qualities the man has for expansion and growth.

For you know by Hudson history we have never slackened, never failed to show each year a marked development in our own growth. And to-day the dealers who are most valuable are the ones who have grown with us.

Our conception of this business is that the dealers and we are partners and we must all make profits.

If you don't know us and would like to tie your future to such a partnership, write us.

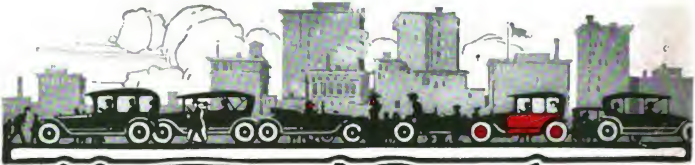
Who knows to what it may lead?

HUDSON MOTOR CAR COMPANY
DETROIT, MICHIGAN

HUDSON SUPER-SIX

Editorial Contents, Page 3

Advertisers' Index—Next to last page



Stewart Products

$50

Warner
Auto-Meter

$6

Stewart
Motor Driven
Warning Signals

$10

Stewart Speedometer
for Fords

Progressive Dealers Know It Pays to Sell Leaders Only

Live dealers everywhere—men who do a big business and are making big money—know by experience that it pays to sell *Leaders Only*. They stock, sell and feature Stewart Products. The wide demand for Stewart Products is extremely significant to the wise dealer. It points out to him the unmistakable trend of public opinion—the tremendous demand for the best known and most widely advertised automobile accessories on the market.

The dealer who has achieved really big success does not waste his time, energy and money in trying to "put across" unknown accessories. He banks on a steady, consistent "turnover." He handles the one established line—the one that is universally accepted as standard. He carries a complete stock of Stewart Products.

Stewart Products offer you a steady source of income all year 'round—not only in Summer, but also in Winter, when you need it most. Determine right now to sell nothing but Leaders. Concentrate on, "boost," feature and sell Stewart Products—the fastest-selling and easiest-to-sell of all automobile accessories.

Stewart-Warner Speedometer Corporation
Chicago, U. S. A.

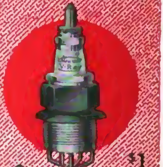
Stewart
PRODUCTS
PRESTIGE
QUALITY
SERVICE
SATISFACTION
USA

$25

Stewart
Speedometer

$3.50

Stewart
Hand Operated
Warning Signal



$1

Stewart V-Ray
Spark Plug

$10

Stewart
Vacuum System

$12

Stewart
Tire Pump

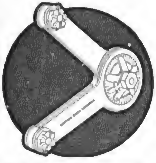
THE AUTO SHOW-
the Place to be Shown

We will demonstrate in a *practical* manner, just what you may expect from

Hartford
EQUIPMENT

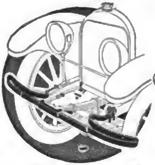
in the way of

Comfort ***Safety*** ***Convenience***



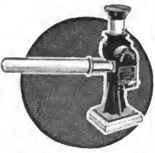
***Hartford**
SHOCK ABSORBER

400,000 car owners use it to make their motoring doobly comfortable. Affords ideal control over present type of active, resilient automobile spring. Absorbs road jolts, jars and vibration, with the result that car rides so smoothly over all roads that its use insures lessened cost of upkeep



Hartford
BUMP ABSORBER
—more than a Bumper

More than mere bumper. Bump-absorbing; shock-absorbing. **Resilient**—it gives before the blow. Two powerful, unbreakable loops of spring steel save the car it guards from all possible damage through collision. A beautifier. Fits any car. Bolts on—no cutting or drilling.



Hartford
AUTO JACK

A marvel of ease in operation. Solid-steel lifting mechanism. Tough malleable-iron case. Long handle; short stroke. Built to outlast the car it lifts. The best jack purchase possible because the most efficiently satisfactory in every respect.

Step right up to our New York Show exhibit at Grand Central Palace and ask to be shown and you'll get a complete, satisfying, convincing demonstration of Hartford Equipment.

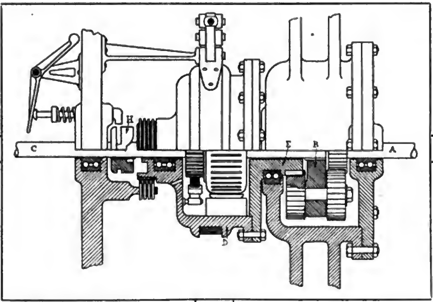
EDWARD V. HARTFORD, Inc.
Heretofore Known as Hartford Suspension Co.
144 Morgan St., Jersey City, N. J.

Makers of the Hartford Shock Absorber, Hartford Cushion Spring, E. V. Hartford Electric Brake, Hartford Auto Jack, Hartford Bump Absorber, Red Rack Jack.

Branches: New York, 1846 Broadway and 212-214 W. 88th St.; Boston, 319-325 Columbus Ave.; Chicago, 2637 Michigan Ave.

Distributors in principal cities. Dealers everywhere.

Flexible Transmission of Power Is the Great Objective of Automobile Manufacture



The Automobile Manufacturer has here an opportunity to obtain exclusive use of an original and effective Electro-Mechanical Transmission by co-operating with the inventor on a royalty basis.

This opportunity is not to be treated lightly. Every manufacturer knows the keen competition for selling features which exists in the automobile world today. Nothing makes a car more significant to prospective buyers than mechanically sound innovations in the power plant developing more flexible transmission of power.

He also knows that everything points to the fact that electro-magnetic transmission will be the big selling feature for several seasons to come. It is not unlikely that the old style transmission will be gradually displaced by the more sound of the electro-mechanical devices.

Here is a chance to put yourself in a position to reap the full benefit of this movement.

The model illustrated and described is merely the simplest expression of the device. It can be directly and easily developed by variations in detail into as complete, efficient and flexible a transmission as the most exacting car owner could wish.

Invented and owned by

Mr. Carlos M. Seidel
Address care of The Automobile

Mr. Seidel's Electro-Mechanical Transmission has two special advantages: it gives a direct drive on high gear, both electrical and mechanical portions being then inoperative; and it requires for the electrical portion only one half of the horsepower of the gasoline engine.

The operation of the transmission can be understood by a reference to the diagram in which A is the engine shaft. This drives the sun wheel of a planetary gear. B is a pinion carrier fixed to the shaft C, which is the driven shaft to which the universal joint is attached for the propeller shaft. The field magnet D turns freely from the shaft C, to which the armature of the electrical machine is fixed. The second sun wheel E is integral with the field magnet D and connects it with the engine through the medium of the planet pinion which are both solid on their shafts.

Now when A is moving and B stationary, the pinions will revolve and the sun wheel E will be driven in the same direction as the engine is revolving at a speed depending on the number of teeth in the sun wheels. The field magnet integral with E, revolves around the armature, and as soon as the current is allowed to flow there is an inter action between the magnetic field and the armature, causing the magnets to drag the armature round with them. This is equivalent to applying a magnetic clutch to the shaft C, tending to start the car.

But there is the reaction to be considered. When the shaft C is turned, the pinion carrier B revolves with it and because of the resistance of the armature which tends to hold back the field magnets and the sun wheel E, divides the driving effort equally between the armature and the planetary gearing

As the car speeds up we reach a position where the shaft C is revolving a little slower than A, the difference in speed being only sufficient to maintain enough current to supply the necessary magnetic grip.

When this happens the dog clutch H is moved locking D to the shaft C. Then the armature and field magnet are revolving at the same speed and no current is being generated, and there is no relative motion in the planetary gear. The car is running on direct drive.

To obtain a reverse, a brake is applied to D stopping it from rotating and causing the pinion carrier and the shaft C to revolve in reverse directions.

If electric connection is made between the storage batteries and the electrical machine it can be used as a starting motor for the engine.

When the engine is idling the unit can be also used through the means of a voltage regulator to boost the charge of the storage battery.

Thus the one electric unit offers possibilities as a clutch, as a starting motor and as a charging dynamo.

The AUTOMOBILE
THE CLASS JOURNAL COMPANY
231–241 W. 39th STREET NEW YORK CITY

TABLE of CONTENTS

Vol. XXXV New York, December 28, 1916 No. 26

Important Trade News of the Week......1075-1085

Editorials 1086

1916—Review of the Year......................1087

S. A. E. Adds 36 Standards in Year...........1093

Automobile Securities Throughout the Year.....1094

Financing a Feature of the Year...............1095

Automobile Registrations for First 6 Months of Past 5 Years............................1096

1916—A 100 M.P.H. Speed Era..................1097

Factory Additions in 1916.....................1098

Automobile Chronology for 1916...............1101

Apperson Bros. Co. New $300,000 Factory......1103

New Eight Succeeds Olds 44...................1104

Majestic Makes Two Eights....................1107

Flexibility in Hydraulic Transmission..........1108

Nelson Is Unique Design......................1109

Chalmers Six Hauls 15 Tons ¼ Mile...........1111

A Cuban Electric Transmission................1112

Carter Tank Pumps Fuel......................1113

Multiple Worm Drive Axle.....................1114

Accessories 1115

Industrial Miscellany..........................1117

The Automobile Calendar......................1117

INDEX TO ADVERTISERS......98-99

WYMAN-GORDON

True Economy of Production

Our notion of true economy in this business is building machinery to fit exactly the work it will be called upon to do.

We work in co-operation with the manufacturer, designing, forging, testing and machining toward the end that each job shall represent the least possible cost for a product that will perform with full and unfailing efficiency.

We guarantee our forgings, not only against imperfections of material, but also as to design, workmanship and delivery. You can obtain the best results possible by bringing your drop forging problems to us and letting us co-operate with you in solving them. Many years of just this sort of work, together with workmen and plant trained and equipped to the highest efficiency, combine to offer you an opportunity unobtainable elsewhere.

So far as we know, our guarantee stands alone.

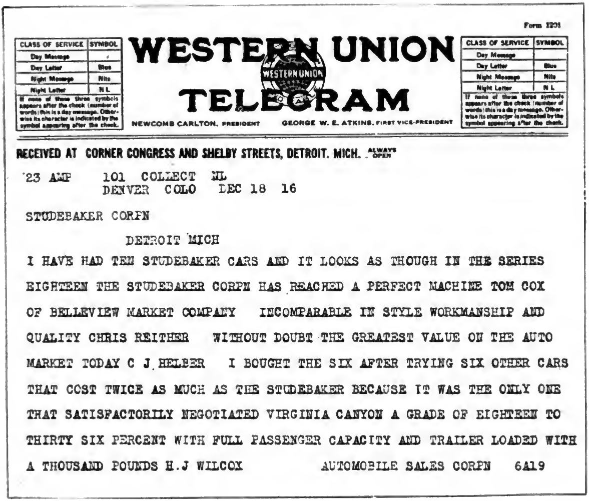
WYMAN-GORDON COMPANY
Worcester, Mass.
Cleveland Detroit

GUARANTEED FORGINGS

Studebaker

Established 1852

Denver's Studebaker Dealer Quotes Words of Praise From Purchasers



Form 1201

CLASS OF SERVICE	SYMBOL
Day Message	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise its character is indicated by the symbol appearing after the check.

WESTERN UNION TELEGRAM

NEWCOMB CARLTON, PRESIDENT GEORGE W. E. ATKINS, FIRST VICE-PRESIDENT

CLASS OF SERVICE	SYMBOL
Day Message	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise its character is indicated by the symbol appearing after the check.

RECEIVED AT CORNER CONGRESS AND SHELBY STREETS, DETROIT, MICH. ALWAYS OPEN

23 AMP 101 COLLECT NL
DENVER COLO DEC 18 16

STUDEBAKER CORPN
DETROIT MICH

I HAVE HAD TEN STUDEBAKER CARS AND IT LOOKS AS THOUGH IN THE SERIES EIGHTEEN THE STUDEBAKER CORPN HAS REACHED A PERFECT MACHINE TOM COX OF BELLEVIEW MARKET COMPANY INCOMPARABLE IN STYLE WORKMANSHIP AND QUALITY CHRIS REITHER WITHOUT DOUBT THE GREATEST VALUE ON THE AUTO MARKET TODAY C J HELBER I BOUGHT THE SIX AFTER TRYING SIX OTHER CARS THAT COST TWICE AS MUCH AS THE STUDEBAKER BECAUSE IT WAS THE ONLY ONE THAT SATISFACTORILY NEGOTIATED VIRGINIA CANYON A GRADE OF EIGHTEEN TO THIRTY SIX PERCENT WITH FULL PASSENGER CAPACITY AND TRAILER LOADED WITH A THOUSAND POUNDS H.J WILCOX AUTOMOBILE SALES CORPN 6A19

If you are interested in a kind of dealer representation that brings prestige with profit—that offers such unlimited opportunities as indicated by the above telegram—address your request for further particulars to

South Bend, Ind.

STUDEBAKER
Detroit, Mich.
Address All Correspondence to Detroit

Walkerville, Ont.

The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, DECEMBER 28, 1916—CHICAGO No. 26

$1,900,000 for Buick Additions

Pres. Chrysler Receives Funds from General Motors Co. for Expansion

FLINT, MICH., Dec. 27—The General Motors Co. has turned $1,900,000 over to W. P. Chrysler, president of the Buick Motor Co., to provide for expansion of the Buick manufacturing facilities, the method of investment being left to Mr. Chrysler's discretion. Plans for a new office building for the company to cost $225,000 are under way.

Lewis Goodyear Consulting Chemist

BOSTON, Dec. 26—Dr. Warren K. Lewis, professor of chemical engineering at the Massachusetts Institute of Technology, has been appointed consulting chemist for the Goodyear Tire & Rubber Co.

Form Britton Carburetor Mfg. Co.

CLEVELAND, Dec. 26—The Britton Carburetor Mfg. Co., this city, has been incorporated with a capital of $50,000, to manufacture carbureters. The incorporators are L. M. Diehl, A. C. Diehl, P. C. Jobes, C. F. Schultz and G. C. Middleton.

Dayton Wire Wheel Co. Formed

DAYTON, OHIO, Dec. 26—The Dayton Wire Wheel Co., this city has been incorporated with a capital of $250,000, to manufacture wire wheels for automobiles. The incorporators are A. N. Wilcox, L. H. Roggs, L. W. James, J. B. Coolidge and B. D. Moore.

Bonus for Employees

DETROIT, Dec. 26—The General Aluminum & Brass Mfg. Co. will pay a service bonus for the year ending Dec. 1, 1916, to all employees who are not stockholders. Under the plan adopted, employees who have been in the service of the company for 4 years or longer will receive 10 per cent of their wages for the year. Those with 3 years of service will receive 7½ per cent of their annual pay. Those with 2 years get 5 per cent. Those with 1 year's service secure 2½ per cent, and those with less than 1 year's service will receive one-half of 1 per cent.

Causan, French Engineer, Joins Chalmers

DETROIT, Dec. 27—Nemorin Causan of the Paris branch has joined the engineering staff of the Chalmers Motor Co. Mr. Causan, who has been investigating automobile conditions in Detroit for the past 7 months, was formerly connected with Delage, Bayard-Clement and Panhard & Levassor and was the designer of several victorious French racing cars.

A New Scripps-Booth Four

DETROIT, Dec. 27—In line with new models to be shown at the coming New York show will be the new four-cylinder Scripps-Booth, just announced. This car will be known as Model G and will have a 3 11/16 by 4-in. Brush design of overhead-valve engine. Other features will include a Zenith carbureter, Remy 6-volt lighting and starting, a cone clutch, 30 by 3½-in. wheels, semi-elliptic front springs with cantilever springs on the rear.

There will be two body types, a three-passenger roadster selling at $930, and a coupé at $1,450. Both will have wheelbases of 110 in.

Chamberlain Heads Packard Truck Sales

DETROIT, Dec. 26—R. E. Chamberlain, truck sales manager of the Packard Motor Car Co. of New York, has been promoted to the position of truck sales manager of the Packard Motor Car Co. of Detroit.

India Bars Motor Imports

All Vehicles Using Gasoline Are Affected—Gasoline Shortage Is Acute

NEW YORK, Dec. 27—The gasoline shortage in India has become so serious that the government there has prohibited for an indefinite time the importation of automobiles, trucks, motorcycles, and all vehicles using gasoline, according to cable dispatches received by Dodge & Seymour, Ltd., export merchants of this city, handling the Ford and Hudson in British India and the Orient. According to the ruling no shipment will be permitted to enter India which has left the United States after Jan. 1, 1917. On top of this announcement comes a further increase of 1 cent in the price of gasoline for export.

India has been a good buyer of automobiles, averaging 400 to 500 a month. There are at present about 20,000 cars there. Automobiles coming into that country are taxed 7½ per cent.

Hayes Mfg. Capital $1,750,000

DETROIT, Dec. 27—Hayes Mfg. Co. stockholders have voted to increase the capital of the company to $1,750,000. The plan calls for 75 per cent stock dividends. Common stock worth $625,000 will be placed on the market.

Muskegon Company Insures Employees

MUSKEGON, MICH., Dec. 26—The Muskegon Motor Specialties Co. for a Christmas gift gave its employees, numbering 300 men, insurance policies ranging from $500 to $1,000, depending on the length of service. The policies are effective as long as the men stay with the concern.

Hall Lamp Co. Buys Badger

Has Option on Brass Co., Maker of Solar Lamps—Late News By Wire

KENOSHA, WIS., Dec. 27—The C. M. Hall Lamp Co. of Detroit has an option for the purchase of the Badger Brass Mfg. Co., this city, and is completing details of the purchase this week. The Badger concern has been well known throughout the industry since its inception as manufacturer of Solar lamps.

Late News Over the Wire

DETROIT, Dec. 27—B. F. Kenyon, who has maintained a hangar in Muskegon, Mich., for the past year, will erect a factory there to make aeroplanes for government mail service.

Many large gasoline distributers in Detroit are suffering from a famine of gasoline because of freight congestion. Prices have advanced 2 to 3 cents, and many gasoline stations have shut down entirely.

The Dort Motor Car Co., Flint, gave each of its employees $600 toward an insurance fund for Christmas.

Business of the Ohio Electric Car Co., Toledo, was 40 per cent higher in December than last year, and the company is adding all the workers it can get.

G. E. Willis, Russian representative of the Studebaker Corp., returned this week from Petrograd.

Packard, Buick and Chevrolet plants are taking inventory and are closed until Jan. 2.

Reynolds, of Studebaker, Dead

DETROIT, Dec. 26—C. J. Reynolds, purchasing agent for the Studebaker Corp., died suddenly at his home last Sunday. Mr. Reynolds was connected with Studebaker for the past 30 years.

Falcon a Four-Wheel Drive

MEMPHIS, TENN., Dec. 23—Automobiles with a four-wheel drive will be manufactured in this city by the Falcon Motor Car Co., recently formed with a capital of $150,000 by local business men. The car will be assembled. The company is composed of J. G. Hamblett, E. E. Karlson, J. R. Manley, G. A. McGill and C. F. Kessler.

Peerless Tire & Rubber Co. Formed

GREEN BAY, WIS., Dec. 23—The Peerless Tire & Rubber Co., which has been incorporated here by F. E. Burrell, J. T. Jessen and A. W. Brown, all of Green Bay, who now are operating a factory in the Ohio rubber district. The company is capitalized at $50,000. It owns the molds and controls the output of the existing plant. The product is being marketed from Green Bay at this time and as soon as practicable it is planned to transfer manufacturing operations from Ohio to Wisconsin.

255,000 Cars Registered in Ohio

COLUMBUS, OHIO, Dec. 23—There are over 255,000 automobiles in Ohio, or more than double the number 2 years ago. It is predicted there will be over 300,000 next year.

300,000 1917 Registrations for N. J.

TRENTON, N. J., Dec. 23—It is estimated that 300,000 automobile licenses will be given in this state in 1917. Beginning Jan. 1, uniform drivers' licenses, costing $3, will be issued, and 3-week permits for beginners, heretofore free, will cost 50 cents.

115,645 Cars in Wisconsin

MILWAUKEE, Dec. 23—Wisconsin registration for 1916 numbers 115,645 cars. The final issue of 1916 licenses was made on Dec. 15, on which date the first applications for 1917 licenses were accepted. The total registration in 1915 was 79,791, showing that Wisconsin absorbed 35,854 cars during the present year. A. J. Cobban, in charge of motor registry in the office of the Secretary of State, estimates an issue of at least 150,000 licenses in 1917.

198,050 Cars in Iowa

DES MOINES, IOWA, Dec. 26—At the close of automobile registrations in Iowa for 1916 the total for the year stood at 198,050 with the total of fees collected at $1,854,501. The increase in the number of cars registered as compared with 1915 is 52,942 and the increase in fees collected is $321,448. A table showing the number of cars registered and the fees collected since 1911 follows:

1911	27,988	$259,736
1912	44,188	485,300
1913	70,068	646,468
1914	106,087	1,040,136
1915	145,109	1,533,053
1916	198,050	1,854,501

Luverne to Expand

LUVERNE, IND., Dec. 26—The Luverne Automobile Co., this city, is enlarging its operations, and in connection with such enlargement it is offering an issue of $50,000 6 per cent cumulative and participating preferred stock.

Shuger Resigns from Auburn

AUBURN, IND., Dec. 23—J. Frank Shuger has resigned as superintendent of the Auburn Automobile Co., after filling that office for 12 years. Mr. Shuger has announced no plans for the future.

Three More Price Increases

Hal, Briscoe and Regal Companies Add to List Prices for 1917 Models

CLEVELAND, Dec. 26—All models of the Hal twelve will be increased in price, effective Jan. 1, 1917. The touring and roadster models will increase from $2,385 to $2,600, the Springfield touring sedan from $3,250 to $3,500, and the Westchester limousine and brougham models from $4,250 to $4,500.

Briscoe Increases Price $60

DETROIT, Dec. 26—The Briscoe Motor Corp. has increased the price of the model 4-24 $60 to $685, effective Jan. 1.

Regal Price Raised $50

DETROIT, Dec. 27—The Regal Motor Car Co. has increased its car price $50, the old price being $695.

Duplex Acquires Plant Site

DETROIT, Dec. 21—The Duplex Motor Truck Co., of Lansing has purchased 15 acres of land on which work will immediately begin for the construction of a plant, 60 ft. by 800 ft. The plans are for a daily production of ten trucks. The new factory will employ 250 men. More than $50,000 worth of new machinery has been ordered which will be used to enlarge the plant that is to be moved from Charlotte.

Oregon Has Car to Every 25 People

PORTLAND, ORE., Dec. 23—The State of Oregon now houses one automobile for every group of twenty-five residents, as compared with one car for every thirty-three people a year ago.

The total registration for the 1916 series is 33,908. For the 1915 series there were only 23,585 cars, the gain for this year being more than 10,000 cars, or 44 per cent.

Day-Elder Motors Corp. Incorporates

NEWARK, N. J., Dec. 26—The Day-Elder Motors Corp., this city, maker of trucks, has incorporated for $1,000,000. The incorporators are C. P. Day, F. G. Elder, and Theo. McMarsh.

Working on Low Fuel Carbureter

DETROIT, Dec. 23—P. S. Tice, formerly chief engineer of the Holly Carbureter Co., is working with F. E. Watts, chief engineer of the Hupp company, developing a carburetion unit for low gravity fuel.

U. S. A. Cars Gain in Argentina

Cadillac Agent in Buenos Aires, Here for Show, Tells of Conditions

NEW YORK, Dec. 26—Albert Fehling of Fehling Bros., Buenos Aires, Argentina, who has been Cadillac agent in Argentina for 14 years, and who has handled the Jeffery line for the past year, arrived in this city Saturday for the purpose of visiting the automobile show as well as factories. Mr. Fehling advises that the demand for U. S. A. automobiles has increased. He is searching for town car bodies which previous to the war Buenos Aires dealers purchased in Europe. In Argentina, where Latin customs prevail, the sedan or coupé types are not in use at all. The business man and members of his family refuse to sit in the same compartment with the chauffeur. Consequently closed types are restricted to limousines and town cars, with a few landaulets. The majority of those using limousines and town cars prefer that passengers occupying the auxiliary seats face forward instead of backward. This seating arrangement calls for a slightly larger closed compartment than where the passengers on the auxiliary seats face the rear.

Mr. Fehling advises that the selling season in Argentina is now at its height and that owing to the very dry season roads throughout the country which are at best in an unimproved condition, have been better this year than in many seasons, a fact which has visibly accelerated the sale of cars. Unfortunately, owing to the dry weather, cable dispatches this week from Buenos Aires place the wheat crop of the country at 50 per cent that of a year ago. This should have a serious effect on the sale of cars unless prices are proportionately higher.

Wide Treads Essential

The sale of automobiles with 56-in. treads is practically limited to the city of Buenos Aires. In the country, or camp, owing to bad roads the 60 or 62-in. tread is imperative. He accounts for the greatly increased sale of several U. S. A. cars to the fact that they have wide treads and Mr. Fehling thinks it practically impossible to sell cars with 56-in. treads in the country districts. Several makes of U. S. A. cars at present in Argentina with 56-in. treads are not selling. The wide tread and 10-in. clearance are essential. Right-hand steering is also essential.

Mr. Fehling is of the opinion that owing to the great difference in price between touring bodies and closed bodies in U. S. A. that it will be necessary for Buenos Aires dealers to begin the manufacture of their own closed types. He states that previous to the war the difference in price between an open body and closed body built in Europe was only 50 per cent of the present difference between open and closed bodies in U. S. A. The greatly added cost of closed types will make it practically prohibitive for the Argentine dealer to import our closed style.

Owing to the winter season coming in the months of May, June, July and August in Argentina, the closed car business alternates with that in this country. This should make it favorable for the purchase of closed cars in New York. It would call for deliveries in Buenos Aires May 1, and for a month or 6 weeks thereafter. Owing to this difference in seasons, it would be possible for U. S. A. builders to seriously consider South American closed-car trade.

Ford Victor in Appeals

DETROIT, Dec. 23—The supreme court of Michigan denied the petition of John F. and Horace Dodge for the further extension of the injunction against the expenditure by Henry Ford of the accumulated cash dividends, and shortly afterward, yesterday afternoon, granted Mr. Ford's petition asking that he be permitted to continue the execution of the contracts for the River Rouge smelting plant on condition that he file a bond protecting Dodge Brothers from possible loss.

Ford Appeals to High Court

DETROIT, Dec. 21—Henry Ford's attorneys will file petitions with the supreme court at Lansing which will bring the injunction issued in favor of Dodge Bros., in their suit against Ford, before the highest court in the State for review.

Ford Wins Windshield Case

NEW YORK, Dec. 23—The Ford Motor Co. has won a decision against the Stahlbrodt Co., Rochester, N. Y., holder of a patent purporting to cover a certain type of windshield commonly known as the "zig-zag windshield," in the United States circuit court of appeals for the second district, in this city.

The decision reverses a prior ruling of a lower court. The shield in question is that in which the lower half inclines rearwardly while the upper half is vertical. It is no longer used on the Ford.

Reo Working Force Is 5000

LANSING, MICH., Dec. 27—The Reo Motor Car Co. working force now numbers 5000, 1500 more men being employed than in the summer of 1915. The company is shipping 100 cars a day on flat cars because of freight congestion.

P. O. Fraud Order Against I. A. L.

Supplemental Order to That of Aug. 2 Bars League Men from Mails

WASHINGTON, Dec. 23—The Postoffice department has issued a fraud order against the International Automobile League, the International Automobile League, Inc., and A. C. Bidwell, president, in the form of a supplemental order to that issued Aug. 2, 1916, under which latter order the Postmaster of Buffalo is instructed not to deliver to 637 Main Street, that city, any mail addressed as above except mail under the frank of a member of Congress or mail matter not under seal. The order also covers the payment of money orders addressed to the above.

In issuing the order the Solicitor of the Department suggests that the names against the fraud order is issued seem to have been adopted by Bidwell for the sole purpose of avoiding the effect of the fraud orders issued against his business last Aug. 2. The order also states that Bidwell has been sending out postcards under the new name as a result of which he seeks to collect alleged past dues for membership in the organization.

Disco Corporation Plans Expansion

DETROIT, Dec. 26—The Disco Electric Starter Corp. will occupy a new building in January and plans to produce starters on a vast scale, the 1917 output being practically sold at this time.

Disco Creditors Meet

DETROIT, Dec. 23—Creditors of the Disco company had their final meeting before the United States court, here, yesterday to receive the last report of the Security Trust Co., trustee. Within the next 30 days, the trust company will distribute the remaining assets in a payment of about 2 per cent. This combined with the two earlier payments of 10 per cent and 12½ per cent will give the creditors about 25 cents on the dollar.

Parker Rust-Proof Factory at Flint

FLINT, MICH., Dec. 26—The Parker Rust-Proof Co. of Detroit will build a branch factory in this city. The company plans to erect twenty-five branch plants in the leading metal cities of the United States.

Western Motor Appliance Moves

DETROIT, Dec. 26—The Western Motor Appliance Co. of Charles City, Iowa, will move its plant to Alma, Mich.

Sweden Has Only 9000 Cars

Fisk Tire Representative from Stockholm Says Poor Roads Hamper Car Sales

NEW YORK, Dec. 26—Sweden will be represented at the New York automobile show by at least one, and perhaps by several automobile and accessory dealers. Hans Osterman of Stockholm, who has sold Minerva cars for 6 years, has been in this country some weeks and will remain until the close of the show circuit. In addition to selling the Minerva in all Sweden since 1908, he has handled a line of tires and accessories, being at present Swedish representative for Fisk tires.

Although Sweden is a little larger in area than Germany, it has a population of only 6,000,000, approximately the same as Australia, and just a little more than half as large as Canada or Argentina. Mr. Osterman estimates that in all Sweden there are approximately 9000 cars, of which number 3000 are in the city of Stockholm. This city has 350,000 population.

At present many of the cheaper makes of U. S. A. cars are represented in Stockholm, and have been sold for years. The bad condition of roads has held back considerably the sale of cars, which has largely been confined to the cities. Up to the present the farming community has not purchased cars and it is doubtful if the farmers will ever be a purchasing factor as in this country. In Sweden farms are smaller.

Centers at Stockholm

The automobile industry of Sweden largely centers in Stockholm where there are thirty dealers, eight of whom are important, and maintain salesrooms similar to those in any American city of corresponding population. Stockholm has not its automobile row as in many of our American cities, but the dealers are now locating in the best quarter of the city. In addition to these dealers there are perhaps fifty garages, some of which have capacity for sixty cars. In the large garages each car is kept in a separate stall as in South American cities. Practically all of the cars in Stockholm are driven by chauffeurs, but the simplifying of cars by electric starters, electric lighting, etc., is already having its influence and private owners and women are taking up driving.

The average car owner in Stockholm has one chassis and two bodies, a summer body and a winter body. The winters in Stockholm are much the same as in New York, but further north the weather gets very cold and in the most northerly points there is winter for several months of the year. In Stockholm are six good body builders who handle much of the closed car trade. Bodies are, however, more expensive than those that were procured from Belgium, France and England previous to the war.

As with all European countries, Sweden has suffered greatly because of the war. Her chief difficulty has been in securing pneumatic tires and tubes which have all had to come through London. As a result of the tire restrictions over one-half of the taxicabs are out of commission and a good percentage of private cars are in storage. Many cars have been operated for several months with the worn-out casings filled with rags. It is expected that for 1917 tire restrictions will be somewhat relieved.

Since the war U. S. A. cars have been about the only ones reaching Sweden. To these might be added a very few German machines. At present ten different makes of U. S. A. cars are entering the country.

Sweden exists practically as a consumer market for automobiles, her status as an automobile manufacturing country being limited to two makes of Swedish cars. One of these is manufactured in quantities of approximately 300 per year. It is made in two models selling at approximately $2,500 and $3,500 each. The car is known as the Scania Vabis. It is manufactured almost entirely in the factory. The other manufacturer produces motor trucks in very small quantities.

Mechanics Plentiful

The automobile industry in Sweden is blessed with plenty of good mechanics. The Swedes are mechanically inclined, and the fact that much good machinery is manufactured in the country has had its influence on developing the mechanical phase of the people.

The importation of cars into Sweden is not seriously hampered by prohibitive custom duties. Automobiles are assessed 15 per cent on the value at the port of entry. This includes freight which at present amounts to $500 to $600 per car.

Tires are taxed at the rate of approximately 35 cents per kilo weight. A kilo is 2 1/5 lb.

There are various custom schedules for accessories: For example, magnetos are assessed 15 per cent of their value. On brass lamps the rate is 12 cents per kilo; on lamps with a nickel finish 20 cents per kilo; and on brass lamps which are enameled 20 cents per kilo. These figures are sufficient to show the general scope of custom duties.

Fine Touring Country

As a country for the use of automobiles Sweden is best described as being hilly, and consequently favored with fine natural beauty attractive to the motorist. The country is well served with macadam roads which wind and twist through the mountain districts as well as the agricultural sections. It is possible to go north from Stockholm approximately 600 miles on good roads. Very satisfactory hotels are found through the entire country. It is possible on a day's drive to average 25 m.p.h. for much of the time. This means hard driving. Up to the present the speed law has been 10 m.p.h., but beginning with Jan. 1, 1917, the legal limit has been raised to 25. It costs approximately $9 to register an automobile in Sweden. This is not an annual registration, but a continuous one, the registration going with the car and not the owner.

Continental Service Stations

To Help Users of Its Engines With Service in Principal Cities

DETROIT, Dec. 27 — The Continental Motors Co., this city and Muskegon, will establish service stations in all of the principal cities in the United States. The company has closed large contracts in both New York and California for the first of the service stations. While the details have not been disclosed, an official of the company states that the plan includes not only the policy of serving the owner but also the manufacturer in solving his service problems.

A special meeting of the stockholders of the company will be held Dec. 30 for the purpose of acting upon the proposal to sell the assets, business and good-will of the company to the new proposed corporation to be formed under the reorganization plan.

Jennings Becomes Advertising Mgr.

BOUND BROOK, N. J., Dec. 22—W. F. Jennings has become eastern sales and advertising manager of the Bound Brook Oil-less Bearing Co., this city. He has been connected with this company for nearly 3 years.

Latour with Chalmers Advertising

DETROIT, Dec. 27—J. F. A. Latour has joined the advertising staff of the Chalmers Motor Co. Mr. Latour was formerly connected with *The Evening Ledger* of Philadelphia.

Collins Joins Harroun Staff

DETROIT, Dec. 26—J. F. Collins has joined the staff of the Harroun Motors Corp. Mr. Collins was formerly the cost and system expert for the Cadillac company.

Ask Forfeiture of Charter

State Authorities File Suit Against All-Steel Co. After Investigation

ST. LOUIS, MO., Dec. 23—The State Attorney General's Department yesterday filed suit in the Circuit Court at Macon, Mo., to forfeit the charter of the All-Steel Motor Car Co. This action was taken after an investigation of A. L. McCawley, head of the corporation department of the office of the Secretary of State. This company recently has been conducting an energetic stock selling campaign here, much of their advertising being done under the name of the Macon Motor Car Co., which name it was explained that the company would take at its annual meeting.

The night before the suit, McCawley met and addressed a mass meeting of those who recently have bought stock and explained that they could reorganize under the name they wished and that the suit would not impair the value of the assets. The suit, he said, was necessary because of irregularities in the actions of the All-Steel Motor Car Co. affairs. He charged that:

Patents of Doubtful Value

The All-Steel company, when organized for $400,000 capital, half paid in, had filed a statement that $5,000 of this was cash and $195,000 in value of patents on a combined body and chassis and device for transmitting power to wheels. He said the company never had $5,000 and the patents had lapsed and were of doubtful value.

The company, he said, removed from St. Louis to Macon without notice.

The change of the record to show 40,000 shares of $10 each instead of 4000 at $100 each, he said, was without notice to his office.

That no explanation had been made of the return of $100,000 worth of stock by C. L. Smith, the inventor, had never been explained.

After hearing these charges and receiving assurance that the present stockholders could retain the real estate, worth including a former buggy factory building, $275,000, practically a present from the citizens of Macon, and that the money already advanced for parts of cars to be assembled for next season's selling, the stockholders voted to reorganize at once.

The present officers of the company are Macon business men, who practically took over the All-Steel company when they believed that it was going to collapse. They have provided the present assets in an endeavor to build up an industry for the town to take the place of the buggy factory. A stock selling office has been maintained at 707 Olive Street, this city, for several weeks and a car of the type that is to be assembled at the plant is on display there. How many of the 40,000 shares at $10 each have been sold is not made public but the end of the campaign is not yet. It is said that later an effort will be made to sell stock to the value of $1,000,000. The company has been making purchases of assembly plant material and of some parts here within the last few weeks and is reported to have paid cash on such purchases.

The present officers and promoters have made no pretense that they expected to use the Smith patents, asserting that the departure for a combined body and chassis and for transmission of power to wheels was too radical an innovation for them to undertake. C. L. Smith, who promoted the all-steel patents, participated in the stockholders' meeting.

Morron Succeeds Meyer

NEW YORK, Dec. 22—J. R. Morron has been elected a director and member of the executive committee of the Maxwell Motor Co., Detroit, to fill the vacancy caused by the resignation of Eugene Meyer, Jr.

J. C. Brady was elected chairman of the board, and of the executive committee in the place of J. C. Jay, Jr. Mr. Jay will continue as a director of the company, and has been elected a vice-president.

Mr. Morron is president and a director of the Atlas Portland Cement Co., and is also a director in the following companies: Baltimore & Ohio Railroad, Chicago, Great Western Railroad, Guarantee Trust Co., the American Surety Co., and the National Bank of the Republic of Chicago.

Steele Succeeds Barber

MOLINE, ILL., Dec. 23—M. A. Steele has become sales manager of the automobile department of the Moline Plow Co., maker of the Stephens car. He succeeds A. C. Barber. Mr. Steele has been connected with the company for several years. He was formerly manager of the Stephens Six factory, where he is succeeded by H. J. Leonard, who assisted him.

B. F. Durham has become associated with the company as assistant sales manager.

Williams Goes to Antipodes

DETROIT, Dec. 23—E. F. Williams, special foreign representative for Dodge Brothers, will leave shortly for Manila, Australia and New Zealand.

$170,000,000 in Overlands

Dealers Contract for Cars to That Value—Co. Has Abundant Material

TOLEDO, Dec. 22—The final group of Willys-Overland dealers to visit that company's factory during the convention added approximately $10,000,000 worth of contracts for cars, bringing the total value of cars ordered during the convention up to $170,000,000. The company built 96,000 cars in the first 6 months of 1916.

John N. Willys, president of the concern, addressed the guests and stated that the shipping facilities of Toledo would be a boon to the company in 1917 and that the company has $30,000,000 worth of raw material on hand, including more aluminum than any other manufacturing concern in the world. A silver loving cup was given to Mr. Willys by Mayor Joseph Bell of Indianapolis as a token from the Gibson Raiders, the salesmen from Indiana and Illinois.

Gardner, of Chevrolet, to Retire

ST. LOUIS, MO., Dec. 23—Russell E. Gardner, president of the Chevrolet Motor Co. of St. Louis, a manufacturing branch of the larger Chevrolet company, will retire from business after the first of the year. He will turn his large plant over to his sons, R. E. Gardner, Jr., and Fred Gardner. Mr. Gardner, who is rated at several millions, came to St. Louis from Tennessee 37 years ago without means. He began at the bottom in the buggy business and later acquired complete ownership of the Banner Buggy Co. and as the business began to fail he absorbed several other plants. It was this equipment that he made the basis of the organization of the Chevrolet Motor Co. of St. Louis.

D. A. C. Honors Hugh Chalmers

DETROIT, Dec. 22—A banquet was held last night by directors of the Detroit Automobile Club as a token of friendship and mark of gratitude for the work of Hugh Chalmers as director of the organization. Mr. Chalmers will retire from the presidency of the D. A. C. on Jan. 1.

Christiansen Goes to Detroit

NEW HAVEN, CONN., Dec. 22—E. S. Christiansen will become manager of the Detroit office of the United Smelting & Aluminum Co., this city. He was formerly purchasing agent. W. T. Schmitt, formerly of the Bosch Magneto Co., has been appointed assistant manager at the Detroit office.

56,539 Fords in October

Schedule for 1917 Calls for 750,000—Average Selling Price $400

DETROIT, Dec. 23—The Ford Motor Co. produced 56,539 cars in October, which is almost equal to the highest month, March, in which 58,394 cars were made. The scheduled output for the current fiscal year is 750,000 cars, as against actual production of 523,920 in the 1916 year and 308,213 in the 1915 year.

The average selling price of the Ford product for the past year was a trifle over $400, gross business amounting to $206,867,000 and cars sold totaling 508,000. With the present $80 reduction on Ford cars, the total gross business for the current fiscal year should be approximately $240,000,000.

Ford Plant Closes for Week

DETROIT, Dec. 21—The Ford Motor Co. will close its plant for the entire week between Dec. 22 and Jan. 3 to aid the railroads to move food and fuel shipments.

F. L. Klingensmith, vice-president of the company states that the officials of the concern do not believe it to be right for the company to use railroads for shipment of cars when the various communities are threatened by famine because of railroad congestion. The suspension means a production loss of 175,000 cars for the week and affects 42,000 workers who will suffer a wage loss of $200,000 a day or $1,400,000 for the week.

The plant will also allow the steel mills which are now far behind on orders to catch up to some extent.

No work will be done during the suspension and no cars will be shipped or coal used except as is necessary to keep the plant just above the freezing point. An attempt will be made later to catch up in production though no plans have been formulated as yet. Officials of the company state that there is plenty of material on hand, that cars are being sold more quickly than they can be made and that the reason for closing is purely a humane one.

Holland Joins Myers Machine

SHEBOYGAN, WIS., Dec. 23—H. F. Holland, Indianapolis, Ind., has been appointed sales manager of the motor truck division of the Myers Machine Co., Sheboygan, Wis., to succeed L. P. Helm, resigned. The Myers company absorbed the Wisconsin Motor Truck Co., Baraboo, Wis., early this year, purchasing the interests of Mr. Helm, who joined the Myers company as manager of the truck department.

Above—Dort five-passenger sedan selling for $1,065. Below—Sedanet listed at $815

Pontiac Tractor Co. Formed

Hubbard, Welsh and Wright Behind Co.—To Sell at $750

DETROIT, Dec. 21—The Pontiac Tractor Co. has been incorporated for $42,000 in this state and will take over the Wright Mfg. Co. plant at Pontiac for the manufacture of a tractor to sell at $750. The officials of the new concern will include M. D. Hubbard, of the Hubbard Spring Co.; Fred S. Welsh, who was at one time connected with the Welsh Motor Car Co., which is no longer in existence, and N. A. Wright, of the Wright Mfg. Co. The tractor has been tried out during the past year and was found to be successful, according to officers of the concern. It is constructed with a steel frame, and a single-cylinder oil-burning engine of 30 to 35 hp. The complete tractor weighs 4200 lb. The company plans to produce from three to five tractors per day.

Four Dort Models for 1917

FLINT, MICH., Dec. 23—The Dort Motor Car Co., this city, is now manufacturing four models, a five-passenger sedan at $1,065, a sedanet with a permanent top but detachable if required at $815, a five-passenger touring car at $695, and the Fleur-de-lys three passenger roadster at $695. All these models are on the same chassis. The sedan, however, carries 31 by 4 tires instead of 30 by 3½, the standard size for all the other models.

Scofield Is Drexel Sales Manager

DETROIT, Dec. 26—H. H. Scofield has joined the Drexel Motor Car Co. as director of sales. He has been connected with the Acme White Lead and Color Works, this city, the Studebaker Corp., General Motors Co. and the Paige-Detroit Motor Car Co. He will have full charge of sales and supervision over advertising and service.

Pearce Elected President

ASHTABULA, OHIO, Dec. 22—A. E. Pearce has been elected president of the Pearce Tire & Rubber Co., succeeding J. L. Smith, resigned. H. J. Atwood was elected secretary-treasurer in place of P. C. Remick, resigned. The following directors remain on the board: A. E. Pearce, H. J. Atwood, J. L. Smith and F. L. Kerr. A. W. Green resigned from the board.

Victor Buys Jenkintown Factory

PHILADELPHIA, Dec. 23—The Victor Motor Co., this city, has purchased the property of the Jenkintown Switch and

Signal Co., north of Philadelphia, where it is planned to make the Victor four. The property includes 25 acres of land and nine buildings owned by the former concern. The cost of the property is $92,000 to be paid within a year. The location previously selected at Grubbs Landing, Del., has been abandoned. C. V. Stahl, vice-president of the company and inventor of the Victor engine, said the company has an order for 5000 cars as soon as completed, out of which fifty are to be shipped to a firm in Norway.

Economy and Bellefontaine Merge

BELLEFONTAINE, OHIO, Dec. 22—The Economy Motor Car Co., of Tiffin, Ohio, and the Bellefontaine Automobile Co., of Bellefontaine, plan to merge and will locate their combined factory in this city.

Blagden American Malleables President

LANCASTER, N. Y., Dec. 22—A. S. Blagden has been elected president of the American Malleables Co., this city, succeeding W. G. Pearce, who has been made chairman of the board. This company specializes in malleable iron automobile castings.

Langerbacher With Duplex Truck

DETROIT, Dec. 21—Andrew Langerbacher has become sales manager of the Duplex Truck Co., of Lansing. Mr. Langerbacher was formerly with the sales organization of the Reo Motor Car Co.

Gerlinger Builds Six-Cylinder Truck

TACOMA, WASH., Dec. 23—The Gerlinger Motor Car Co., this city, is building a ton and a half, six-cylinder, self-starting and electric-lighted truck that will be ready for delivery Feb. 1, 1917.

Detroiter Convertible Coupé and Sedan

DETROIT, Dec. 26—The Detroiter Motor Car Co., this city, has brought out a convertible coupé and sedan, selling at $1,398 and $1,373, respectively.

Paterson Chummy Roadster

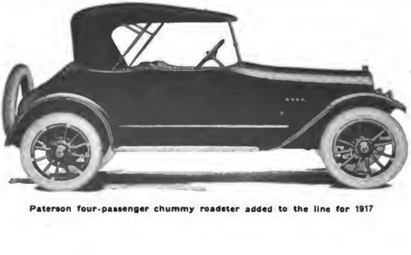
New Model Added to Line—Bodies Improved for 1917—Few Changes

FLINT, MICH., Dec. 19—The W. A. Paterson Co. is continuing its six-cylinder chassis without change for 1917. In addition to the touring body, however, a chummy roadster has been added and a number of refinements are incorporated in both.

The movements in the 1917 touring car are principally in the way of providing more room in the body. The lines are longer and wider, giving a greater amount of room. The front seat is 41 in. wide by 18 in. deep. The rear seat is 48 in. wide by 20 in. deep. This is about 5 per cent increase in seating area.

Four passengers are seated in the new roadster, which is on the same chassis of 117 in. wheelbase. The two front seats in the roadster are 17 in. wide by 16¾ in. deep and the rear seat is 36 in. wide by 16¾ in. deep. This is a cloverleaf layout.

The Paterson chassis has a six-cylinder Continental engine, Delco electrical equipment, Willard battery, Stewart vacuum feed, Stromberg carbureter, Goodrich tires, and one-man top.



Paterson four-passenger chummy roadster added to the line for 1917

Pfeffer Returns from Cuba

DETROIT, Dec. 21—C. A. Pfeffer, formerly vice-president and assistant general manager of the Chalmers Motor Co. has returned from his visit to Cuba.

Spohn Leaves Class Journal to Join U. S. Ball Bearing Co.

CHICAGO, Dec. 26—Howard L. Spohn, for the past 8 years with the Class Journal Co., has become commercial manager of the U. S. Ball Bearing Co. of this city Jan. 1. The entrance of Mr. Spohn into this corporation in no wise infers any changes in the organization but is due to anticipated enlargement of manufacturing facilities and the acquiring of additional allied interests.

Walter H. Strom remains as secretary and general manager with an augmented factory organization including S. W. Brandel, factory manager; M. Zelinski, superintendent in charge of production; H. N. Corsline, shop engineer in charge of inspection; W. E. Hutchinson, purchasing manager, and A. L. Moyel, office manager. E. B. Fleisch continues as sales manager, with K. I. Fosdick remaining as western representative.

Chandler Increases Wages 10 Per Cent

CLEVELAND, Dec. 23—The Chandler Motor Car Co., this city, has increased its wages 10 per cent, affecting all of its employees working on an hourly wage basis. A liberal bonus is given in addition, effective Jan. 2. On July 20, the men employed on an hourly wage basis who are on the company's payroll July 1, will be paid a 10 per cent bonus on the entire wages paid during the year, July 16, 1916 to June 30, 1917.

To Talk on Headlight Situation

NEW YORK, Dec. 27—The Illuminating Engineering Society will hold a meeting on the evening of Jan. 10 in the Engineering Building, 29 West Thirty-ninth Street, which will be devoted to the subject of automobile headlights.

A paper is to be presented by W. F. Little of the Electrical Testing Laboratories entitled "A Survey of the Automobile Headlight Situation." This paper will present a symposium of the opinions of various men in the lighting and automobile engineering fields in an attempt to arrive at a consensus as to the requirements. The paper will then describe various headlights upon the market, and in connection with these a demonstration will be made of the lamps in general use, together with several types which have not as yet been placed upon the market.

Following the presentation of this paper it is planned to hold a symposium of engineers, legislative authorities, police officials, etc., in an attempt to secure a good discussion of the headlight problem from a number of different viewpoints.

Charter Oak in New Britain

HARTFORD, CONN., Dec. 23—Temporary factory quarters for the newly formed Eastern Motors, Inc., Hartford, makers of the Charter Oak car, have been secured in New Britain, 10 miles from Hartford and the home of the Corbin. At the offices of the concern it is said that Hartford is to be the ultimate location of the business.

Paige Production Expands

Company Installs Conveyors—Increases Floorspace of Factory—Adds Stockroom

DETROIT, Dec. 23—Many changes for the purpose of increasing production have been made in the Paige-Detroit factory in the past year. Particular effort has been expended toward securing the most modern mechanical improvements, and the company has equipped the plant with every efficient device, besides erecting a new structure 60 by 300 ft. and four stories high which is used entirely as a stockroom. The new building is so arranged that one side of the first floor is convenient for delivery by wagon or truck, while the other side opens directly upon the railroad tracks, allowing freight cars to empty into it. The third and fourth floors feed to the structure adjoining, allowing the stock to be efficiently handled on its journey from the stockrooms to the machine shops and assembly departments. The recently added building gives the company more than 500,000 sq. ft. of floorspace, an increase of 40 per cent as compared with space available in 1915.

The assembly work has been arranged upon the progressive plan, and includes several unique features. The building in which machine and assembly work is done is 60 by 600 ft. The third floor is used for the painting and assembling of frames and wheels. The frames enter the room, receive the necessary rivets, and are placed upon a cable conveyor which carries them to a huge tank where they are cleaned with gasoline and given the first coat of paint. From here they travel on the conveyor to the ovens, where they remain for 110 min. and finally emerge dried and ready for the second coat and succeeding oven. Each frame receives three coats of paint, applied by the spraying method, before it is ready for the wheels, which have been assembled on the same floor and include the rims, tires and tubes. A chute at the end of the structure is used to convey the frame to the floor above, where it is placed on a conveyor and travels the entire length of the building, constantly receiving the various parts it needs until it becomes the finished car, ready for final inspection. The conveyor on this floor consists of a double-track system, one for the little six and the other for the big six, and is unique in its construction, as the return cable lies directly under the pulling cable, allowing more floor space for additional work. The tracks run through the center of the room, and stock booths are arranged on each wall so that the workmen may feed the stock, easily and with few steps, directly to the chassis.

Other floors in this building are used for special paint, equipment and winter top departments, and the entire first floor is devoted to machine work, block testing and adjustment of engines. The block test room is 125 ft. long, and here the engines may be seen hanging from a powerful overhead cable conveyor which carries them in and out of the room for the test. An average of 150 engines are tested daily.

The Paige-Detroit Motor Car Co. employs 900 men now, as against 600 men in 1915. It is doing a business of $2,000,000 a month, as compared with $1,000,000 in 1915. The output this year has been more than 14,000 cars, and plans are being made to increase the production to 20,000 in 1917.

Fergus Moves Offices to Newark

NEW YORK, Dec. 22—The Fergus Motors of America has moved its local office at 80 Maiden Lane to Newark, N. J., at 370 Jelliff Avenue.

One of the rooms where the White Motor Co. of Cleveland entertained 6000 persons at luncheon during the dedication of the new manufacturing building of the company last week. While part of the throng were served at luncheon hundreds of others were entertained by Highlanders and by a band of forty pieces and stringed orchestra of twenty pieces, both of which are composed of men in the White plant

N. S. W. Shipments Not Economical

American Makers Should Send Cars Direct to Retailer in Australia

SYDNEY, AUSTRALIA, Nov. 22—The future of automobile sales of American cars in Australia was the major subject of discussion at the annual dinner of the Motor Traders' Assn. of New South Wales last night. The consensus of opinion is that U. S. A. manufacturers are not giving enough attention to shipment of automobiles and the general business in connection with automobile export trade to hold an even scale against European concerns who have given immeasurably more attention to this subject. There was an expected difference of opinion on this subject but the majority of the speakers were of the opinion that Americans do not do their shipping in so economical a way as the British manufacturer.

Practically all of the speakers were displeased with the method of American automobile and accessory manufacturers handling the Australian trade through indent or clearing houses instead of dealing direct with the Australian dealer. It is necessary to pay these indent houses a commission as they are rarely retailers and do not give any assistance to the retailer. They simply control the importation of the article, and collect the middle man's profit without giving any benefit. The disadvantage is that the retailer has his profit cut proportionately. European houses do not follow this plan but deal direct.

Many members of the Motor Traders' Association have visited England recently, within the last few months and have returned with the opinion that British manufacturers are already organizing for the production of standardized motor cars, which will be taken up immediately war hostilities cease. It is not thought that these British makers anticipate competing with Ford but rather that they will be prepared to compete in a price field with the majority of U. S. A. cars selling above the Ford list.

First Harroun Building Foundation In

DETROIT, Dec. 22—The foundation of the first unit of the Harroun buildings, at Wayne, was finished Wednesday. The structure will house the assembly units and will be 75 by 540 ft. when completed. The power plant will be started in course of erection within the next 2 weeks.

Penn Counties Truck Buys Land

PHILADELPHIA, Dec. 22—The Penn Counties Motor Truck Co., supported by

New York financiers, has purchased a tract of land along the Central Railroad of New Jersey at Allentown, Pa. The work of erecting a plant has already been started. Martin E. Kern, one of the organizers of the International Motor Car Co., is vice-president of the new enterprise which is capitalized at $500,000. Trucks of ½ to 2-ton capacity will be made. The company plans to turn out 2000 trucks complete within the coming year.

Hoelzle, of Parker Rust-Proof, Promoted

DETROIT, Dec. 22—E. C. Hoelzle, who has been the assistant to the general manager, has been elected assistant treasurer of the Parker Rust-Proof Co. of America.

Cornelius Promoted by Rust Proof

DETROIT, Dec. 21—W. M. Cornelius has been elected assistant secretary of the Parker Rust Proof Co. of America. Mr. Cornelius has been assistant to the president of the company.

Core Springfield Body Advertising Mgr.

NEW YORK, Dec. 22—Guy Core has resigned as advertising manager of the Sparks-Withington Co., Jackson, Mich., to take a similar position with the Springfield Body Co.

$1,250,000 Addition in Beloit

Concerns Allied with Automobile Industry Responsible for Bulk of Expansion

BELOIT, WIS., Dec. 23—More than $1,250,000 has been expended in Beloit, during 1916 by industrial concerns for extensions to works, and the bulk of the improvements are attributable to the heavy demands of the gas engine, automobile, accessory, garage equipment and allied interests, according to the annual report of the Beloit Commercial Club, now on the press.

The Stewart-Warner Speedometer Corp. is expending $200,000, providing for 400 more workmen, and adding 81,864 sq. ft. Fairbanks, Morse & Co. added 181,208 sq. ft., provided for 1200 to 1500 more men, and spent $500,000. Other large interests included in the figures are the Lipman Mfg. Co., compressors, garage pumps, etc.; Gardner Machine Co. and Chas. H. Besley & Co., disk and other grinders for metal-working shops, and P. B. Yates Machine Co.

Ford Plans Plant for Belfast

DETROIT, Dec. 26—Reports from Belfast, Ireland, state that Henry Ford is seeking a site for a factory to cost $1,000,000 and to employ 2,000 men. F. L. Klingensmith, vice-president of the Ford Motor Co., states that he has heard nothing of the proposed Belfast plant, but that the project is in the hands of the Ford Co. in England. The English Ford company will operate with British capital and directors by paying the Ford Motor Co. royalties on patents. Plans have been completed for factories in Manchester and Southampton.

Columbia Starting Production

DETROIT, Dec. 22—The Columbia Motor Co. will occupy its new Detroit quarters on January 1 and will immediately begin production.

New Men at Grant Plant

CLEVELAND, Dec. 21—F. F. Wood has been appointed as assistant sales manager of the Grant Motor Car Corp. Mr. Wood was formerly with the Ford Motor Co. at the Akron branch. J. B. Bray, who was formerly with the Curtis Airplane Co., has been made the service manager of the Grant company.

Bassett With Buick Company

DETROIT, Dec. 21—Harry H. Bassett has been appointed assistant general manager of the Buick Motor Co., of Flint. Mr. Bassett was formerly general manager of the Weston-Mott Co.

Above are portrayed only a part of the 8000 persons in attendance at a dance given by the White Motor Co. of Cleveland as a feature of the factory house warming in the new manufacturing building, which is 240 by 304 ft. Between dances the guests were shown motion pictures of the factory's products in unusual form of service as well as current feature films. Cabarets were also held

Northwest Conditions Favorable

Though Car Shortage Is Felt, Business Improves and Bank Deposits Grow

MINNEAPOLIS, Dec. 23—General conditions throughout the Northwest are favorable in spite of the reduced wheat crop, railroad car shortage and higher prices of coal. According to the Northwestern National Banks' Review of November conditions, general business is improving, bank deposits are growing and collections are good. Those sections which suffered most from disappointing harvests are not complaining. Even in these districts bank deposits are a little ahead of a year ago. Bank deposits are generally 25 per cent ahead of a year ago.

Car shortage, evidenced at Minneapolis is more serious this year than formerly, and is having an influence on those industries handicapped by lack of cars, and although a larger general business than ever before is being conducted the rolling stock has not been materially added.

A commendable action of one of the railroads is noted in the daily press, that of the tender of the use of its ore cars from certain mining regions in the Northwest to relieve the demand in another section.

Agricultural districts in this territory are not being greatly affected by the car shortage. Some bankers report no particular trouble, though others note some inconvenience. Shippers of hay and potatoes in west central Minnesota are experiencing difficulty in moving their produce. Western North Dakota is finding an insufficiency of cars for its wheat consignments that is surprising considering the crop shortage. It is believed that a considerably larger percentage of wheat was held over from last year in that section than was counted upon. Lumbering interests and loggers in northeastern Minnesota are feeling the car shortage, and it also exists at the head of the lakes. The extensive mining districts of our territory are experiencing no great difficulty. The copper district in northern Michigan is reported as being practically free from the shortage. Grain receipts here are lower than a year ago. The daily average for this market for September, October and November of 1916 is about 945,000 bushels; for the same period last year the daily average was 1,218,000 bushels, and in 1914 and 1913 the averages were 934,168 bushels and 827,761 bushels respectively. Our terminal elevators are filled to about three-fourths their capacity and grain is arriving at the rate of about 900,000 bushels per day. The flour mills are feeling the effect of the car stagnation, but at this writing only two or three of the smaller ones had been forced to stop grinding, and this for very short periods of time. Weather conditions have been favorable for traffic, on the whole, but this cannot be expected to continue as the winter progresses.

Bogus District Manager of Commerce Co. Swindles Dealers

DETROIT, MICH., Dec. 23—The Commerce Motor Car Co., truck manufacturer of this city has wired THE AUTOMOBILE as follows:

"An imposter claiming to represent us as district manager is operating in Pennsylvania, West Virginia, and Ohio, passing bogus checks on dealers and hotelmen. These checks are printed with our name and are on the First National Bank of Detroit. Checks are signed F. M. Wilson, manager of sales. The trade should be on the lookout for such a person and wire us promptly in case he is located."—(Signed) Commerce Motor Car Co., Detroit, Mich.

Akron-Ardmore Tire Company Formed

ARDMORE, OKLA., Dec. 26—The Akron-Ardmore Rubber Co. has been organized at Ardmore, Okla., with a capital of $1,000,000. John C. Harmony, E. D. Ford, C. A. Besaw, A. C. Fox and R. G. Wood have been active in the formation of the concern.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum, lb.	.62	.62	.62	.60	.60	...	— .02
Antimony, lb.	.14½	.14½	.14	.14	.14	...	— .00½
Beams and Channels, 100 lb.	3.42	3.62	3.62	3.62	3.62	...	+ .20
Bessemer Steel, ton	55.00	60.00	60.00	60.00	60.00	...	+5.00
Copper, Elec., lb.	.33½	.33½	.31	.31	.31	...	— .02½
Copper, Lake, lb.	.33½	.33½	.31	.31	.31	...	— .02½
Cottonseed Oil, bbl.	12.35	12.50	12.45	12.50	12.50	...	+ .15
Fish Oil, Menhaden, Brown, gal.	.72	.72	.72	.72	.72	...	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	...	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	...	...
Lead, 100 lb.	7.75	7.75	7.75	7.75	7.75	...	...
Linseed Oil, gal.	.93	.93	.93	.93	.93	...	...
Open-Hearth Steel, ton	55.00	60.00	60.00	60.00	60.00	...	+5.00
Petroleum, bbl., Kans., crude	1.20	1.20	1.20	1.20	1.30	...	+ .10
Petroleum, bbl., Pa., crude	2.75	2.75	2.75	2.75	2.75	...	...
Rapeseed Oil, refined, gal.	.98	1.00	1.00	1.00	1.00	...	...
Rubber, Fine Up-River, Para, lb.	.79	.79	.79	.79	.79	...	...
Rubber, Ceylon, First Latex, lb.	.78	.77	.77	.75½	.75½	...	— .02½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	...	...
Tin, 100 lb.	42.63	42.00	41.25	40.50	40.50	...	—2.13
Tire Scrap, lb.	.06½	.06½	.06½	.06½	.06½	...	...

Steel Prices Rise $5 a Ton

Copper Declines 2½ Cents a Lb.—Kansas Crude Higher—Tin Declines $2.13

NEW YORK, Dec. 27—The materials market last week was on the whole lower. With the exception of a rise in steel prices, the market was otherwise featured with substantial losses in the other metals and rubber. Bessemer and open-hearth steel rose to $60 per ton, a gain of $5. Kansas crude petroleum, accompanied by a general rise throughout the country in gasoline, went up 10 cents a barrel to $1.30.

Aluminum dropped 2 cents to 60 cents a pound. Copper is now quoting 31 cents a pound, a decline of 2½ cents. Tin dropped to $40.50, a loss of $2.13 per 100 lb.

The demand for gasoline is expected to be very large after the war, as its use in Europe is bound to increase enormously. At present in such countries as England, France and Italy restrictions are placed on consumption, and gasoline is so scarce that prices are prohibitive. With these restrictions removed and with the use of the automobile in all countries a growing factor, gasoline requirements will be enormous. The Standard Oil Co. yesterday, probably in anticipation of a larger demand from Europe, raised the price of gasoline 1 cent for export.

Fisher Body Sales Increase

DETROIT, Dec. 21—The sales of the Fisher Body Corp. for November amount to $1,650,000, an increase of $180,000 over October, and $400,000 higher than any previous month in the fiscal year. Total sales for the past 9 months are 65.56 per cent higher than for the same period in the previous year.

P. R. Creditors Get Dividend

DETROIT, Dec. 21—Creditors of the defunct P. R. Mfg. Co., have received checks covering 5 per cent of their claims. A second distribution of 50 per cent will be made within the next 3 months. The receivership is giving a large return on the common stock in addition to meeting all claims and taking up the preferred.

Universal Heater Co. Formed

MARTINTON, ILL., Dec. 26—The Universal Heater Co., this city, has been organized to manufacture a heater for automobiles. Until the company can open its own plant, the heaters will be manufactured by the Moline, Ill., Foundry Co. The heater is built in the shape of a foot rest and may be placed either in the rear or front seat of a car and will fit any automobile or other vehicle operated by a gasoline engine.

Dividends Declared

Hupp Motor Car Corp. quarterly of 1¾ per cent on 7 per cent cumulative preferred, payable Jan. 2 to stock of record Dec. 20.

Chalmers Motor Corp., 75 cents a share, payable Jan. 15 to holders of record Jan. 5.

Signal Motor Truck Co., 3½ per cent, to be paid Jan. 2 to stock of record on Dec. 26.

Billings & Spencer Co.; extra of 3 per cent with quarterly of 2 per cent, payable Jan. 1 to holders of record Dec. 23.

Herschell-Spillman 100 Per Cent Dividend

NORTH TONAWANDA, N. Y., Dec. 26—The Herschell-Spillman Co., this city, will pay a 100 per cent stock dividend, in addition to the regular quarterly cash dividend.

Hall Lamp Extra Dividend

DETROIT, Dec. 23—The Hall Lamp Co. has declared an extra dividend of 2 per cent for December on the $600,000 outstanding common stock, making a total of 4 per cent for the month.

Automobile Shares Are Firm

Subjected to Severe Grilling at Hands of Bears—General Motors Drops 100 Points

NEW YORK, Dec. 27—Despite the fact that they were subjected to a severe gruelling at the hands of the bears, automobile and accessory securities were conspicuously firm in last week's sensational market. Though the automobile shares were lower on an average last week, they did not decline as much as was expected, considering the light demand before the landslide. The demand picked up, however, and yesterday stocks were higher.

Chevrolet, Hupp, International Motors, Regal and Willys-Overland, featured the market with substantial gains. General Motors, which has been subject to spasmodic jumps of 100 points, either way, dropped 100 points to 500 last week. Springfield Body common was a little weak at 70, a loss of 20 points.

Studebaker and Willys-Overland held up strong with small losses. The common of the latter rose 1¼ points. It is estimated that the profits of the Studebaker Corp. for the fiscal year ending Dec. 31 will amount to between $10,500,000 to $10,800,000.

The $1,000,000 Paige-Detroit 7 per cent cumulative serial preferred was several times oversubscribed and the books of the underwriters have been closed. The stock, which is now selling above its issue price, was placed largely with investors. It is the first serial issue to be placed by an automobile company and will be redeemed at the rate of $100 par value each year from Jan. 1, 1918, to Jan. 1, 1927, inclusive.

General Motors Extends Time

NEW YORK, Dec. 27—The time to exchange preferred and common stock of the General Motors Co. of New Jersey for securities of the General Motors Corp. of Delaware, on the basis of 1 1/3 shares of new preferred for one share of old and five shares of new common for one share of old, has been extended to Jan. 19. Exchanges will be made as of Nov. 1, last. There have been deposited 117,406 shares of preferred and 103,071 of common under the new plan.

General Motors on Exchange

DETROIT, Dec. 21—General Motors new common was admitted to the New York stock exchange Wednesday morning. In their application for admittance, the General Motors Corp., which will take over the General Motors Co., stated that of the $45,314,000 common outstanding Dec. 9, the Chevrolet Motor Co. held $16,644,500 in one certificate.

Carl Page Takes Over Jordan

NEW YORK, Dec. 27—The Carl H. Page Motors Co., this city, has taken over the distribution of the Jordan car, formerly handled by John G. Dale, a former distributor of the Simplex and now handling the Phianna.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	72½	73	—7½
J. I. Case T. M. Co. pfd.	86	90	+ ¾
Chalmers Motor Co. com.	125	140	—5
Chalmers Motor Co. pfd.	100	105	—5
*Chandler Motor Car Co.	98	102	—5
Chevrolet Motor Co.	125	135	+17
Fisher Body Corp.	37	41	—1
Fisk Rubber Co. com.	70	80	..
Fisk Rubber Co. 1st pfd.	110	115	..
Fisk Rubber Co. 2d pfd.	90	100	..
Firestone Tire & Rubber Co. com.	135	140	..
Firestone Tire & Rubber Co. pfd.	107	108	..
*General Motors Co. com.	500	800	—100
*General Motors Co. pfd.	120	125	+6
*B. F. Goodrich Co. com.	59¾	60	—4⅛
*B. F. Goodrich Co. pfd.	110	112	—3½
Goodyear Tire & Rubber Co. com.	285	290	—5
Goodyear Tire & Rubber Co. pfd.	108¾	109½	..
Grant Motor Car Corp.	7	9	..
Hupp Motor Car Corp. com.	3½	4	..
Hupp Motor Car Corp. pfd.	88	92	+8
International Motor Co. new com.	12	17	+2
International Motor Co. 1st pfd.	60	80	+10
International Motor Co. 2d pfd.	20	40	—10
*Kelly-Springfield Tire Co. com.	58½	60	—9
*Kelly-Springfield Tire Co. 1st pfd.	94	96	—1
*Lee Tire & Rubber Corp.	30	31	—3
*Maxwell Motor Co. com.	53	53½	—6
*Maxwell Motor Co. 1st pfd.	72	73	—2
*Maxwell Motor Co. 2d pfd.	37	37½	—3
Miller Rubber Co. com.	245	250	—5
Miller Rubber Co. pfd.	106	107	..
Packard Motor Car Co. com.	170	173	..
Packard Motor Car Co. pfd.	100	103	..
Paige-Detroit Motor Car Co.	40	41	— ½
Peerless Truck & Motor Corp.	16	18	—2
Portage Rubber Co.	178	182	..
Regal Motor Car Co. pfd.	23	30	+3
Reo Motor Car Co.	41	42	+1
Saxon Motor Car Corp.	65	75	—8
Springfield Body Corp. com.	70	85	—20
Springfield Body Corp. pfd.	115	130	—5
Standard Motor Construction Co.	6	9	+1
Stewart-Warner Speed. Corp. com.	97	100	—5
Stewart-Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	111	112	—1
*Studebaker Corp. pfd.	107½	112	..
Swinehart Tire & Rubber Co.	..	85	..
United Motors Corp.	45¾	46	—4
*U. S. Rubber Co. com.	60	62	—5½
*U. S. Rubber Co. pfd.	111½	113	— ½
White Motor Co.	48	50	— ½
*Willys-Overland Co. com.	37¾	37½	+1¼
*Willys-Overland Co. pfd.	96	98	—2½

*At close Dec. 23, 1916. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	46	47¼	..
Chalmers Motor Co. com.	120	135	..
Chalmers Motor Co. pfd.	110	..	..
Continental Motor Co. com.	39⅛	39½	—4¼
Continental Motor Co. pfd.	9¼	..	..
Ford Motor Co. of Canada.	..	290	..
General Motors Co. com.	..	800	..
General Motrs Co. pfd.	118½	121½	..
Maxwell Motor Co. com.	49	53	—13
Maxwell Motor Co. 1st pfd.	79	83	..
Maxwell Motor Co. 2d pfd.	34	37	—6
Packard Motor Car Co. com.	..	170	..
Packard Motor Car Co. pfd.	..	101	..
Paige-Detroit Motor Car Co.	39¾	39¾	+ ¼
W. K. Prudden Co.	49	51	—1
Reo Motor Car Co.	38⅜	38⅜	—3⅜
Studebaker Corp. com.	111½	114½	— ½
Studebaker Corp. pfd.	107	..	..
C. M. Hall Lamp Co.	..	30¾	..

INACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Atlas Drop Forge Co.	30	34	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	25	..	..

The AUTOMOBILE

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Pilgrims from Abroad

MORE automobile engineers, manufacturers and dealers from other lands will attend the coming national shows at New York and Chicago than ever before in the history of the industry. For months many of them have been visiting factories in our great production centers, studying methods of manufacture and marketing as well as the points of construction in the cars themselves.

Now they will have an opportunity of viewing the products which will represent the industry for 1917, grouped under the most favorable conditions possible for imparting a correct perspective

When a representative of an U. S. A. manufacturing firm returns from abroad, he is immediately besieged by people who are anxious to learn the conditions and opportunities for business development in the countries he has visited, and it is not only the people with whom he comes into daily association who seek this information. Often he receives letters and telegrams from companies and individuals all over the United States who are interested in his experiences and the knowledge he has gained. Similarly with the men from other lands who return from a sojourn in this country.

It must be remembered that these men will carry home with them impressions of our methods, our products and their value, which cannot fail to influence the markets in their respective countries, and every member of the industry who comes in contact with these men should keep this fact in mind, as it may mean an enormous difference in dollars and cents in the future development of our export business.

The Little Things

WHILE newspapers and the trade press have frequently lectured American manufacturers for slackness and lack of perspicacity in handling their export business, there is apparently some basis for complaints on the subject. For example, Latin-Americans, in buying tires of European manufacture, have been accustomed to receive inner tubes packed complete with nipple, washer and dust cap, so that they can be put on without depending on possible relics in the possession of the purchaser. Many of the leading tire makers of the United States, partly due to increased cost of materials and manufacture, and partly because of no demand for these details of equipment on the part of U. S. A. car owners, have discontinued the practice of furnishing these parts with their inner tubes. This action has caused no complaint in this country, which is perhaps the reason that these tire makers have not considered its effect on their export business.

In Cuba, Porto Rico and the South American countries, the omission of these almost negligible details has caused much dissatisfaction with the result that many car owners who have been converted to the use of U. S. A.-made tires since the beginning of the European war will return at once to the use of European tires as soon as possible.

Our manufacturers should be careful to take into consideration at all times not only the different conditions under which their products operate in other countries, but also the peculiarities of demand in each market which can only be brought to the surface by a close study and intimate relationship with the people who are buying these products.

A New Era

THE year just closing marks a new era in the automobile industry, one that has been unequaled in production and progress. Hampered on every side by a shortage of materials, with high prices, higher wages, and a freight car shortage, the manufacturers are to be commended on their wonderful showing. Financial statements show much larger returns, dividends have been frequent and large, and in general the automobile and allied industries have gone up another step toward the pinnacle of success.

What are we to expect of 1917? What new marks will be recorded? Will we be prepared for conditions, if the war should stop? What new production marks will be made by the further standardization work of the S. A. E? The year 1916 has been phenomenal in the demand for automobiles. Will 1917 mark another record, and if so, are we prepared to take care of it?

1 9 1 6

The Dawning of a New Era in The Industry

¶ Unparalleled Growth in Production, Registration and Exportation of Cars Marks New Epoch in Progress During the Year.

¶ Notable Development of Year Is Consummation of Mergers Involving Large Companies and Refinancing To Meet New Conditions Which Now Confront Manufacturers.

As each year comes and goes, there is usually some dominating feature, marked and epoch-making, brought out in the industrial world, either through invention, or through other important manifestations. The automobile industry, which is occupying a leading position in the world's business activities, has each year come to the fore with its progressiveness and with its keen insight to the future. The year 1916 will be recorded as one in the automobile industry of unprecedented production and expansion, of record earnings and exports, of big mergers, and of an increased domestic demand.

This year has seen the farm tractor enter the zone of larger production. A step ahead has been taken by aviation, and the government's huge appropriation of tens of millions should have untold influence on the science, coming as it does at such an early age in the art.

Over 3,000,000 Cars

Notwithstanding a scarcity of materials and consequently high prices, automobile registrations have passed the 3,000,000 mark, some of the large cities having more automobiles registered than a few of the European countries. This year has seen the reduction of the working day, with large wage increases. Extraordinary dividend payments have been frequent, reflecting the large earnings of the automobile and accessory industry. Welfare work has been taken up more extensively, the worker being benefited by more hygienic working conditions. More companies have been refinanced than in previous years as a result of demand. A record demand has had to be taken care of, thereby necessitating large plant additions. All automobile shipment records were broken in 1916, despite a freight car shortage, nearly 250,000 carloads of automobiles being shipped by the factory during the first 11 months.

Several patents have been adjudicated during the year. The Perlman demountable rim suit against the Standard Welding Co. was of more than ordinary interest, because it affected the use of demountable rims on nearly all the automobiles made and now in service. The restrictive injunction, entirely preventing manufacture, was for a time one of the most serious situations faced by the industry in many years.

Important Patents Adjudicated

The Hanlon adjustable windshield patent, which had been adjudicated and declared valid and infringed by Rauch & Lang and the National Automobile Chamber of Commerce, was brought before the United States Circuit Court of Appeals, where the injunction was dissolved, affecting all the members of the National Automobile Chamber of Commerce and also the Rauch & Lang Carriage Co. The Hanlon patent covers a windshield using a double glass, which can be placed at an angle, forming a roof to keep rain or sleet from the vertical pane. The device is now free for general use.

The final decree in the Austin-Cadillac two-speed axle case was signed in the early part of the year, sustaining the patent and preventing its manufacture except under license. Suit was started by W. S. Austin, of the Austin Automobile Co., in 1914, claiming infringement on his two-speed axle patent, No. 1,091,618, issued March, 1914.

Other patents were upheld, including the Discher patent covering a bumper bracket construction. G. F. Discher, president and general manager of the Gemco Mfg. Co., Milwaukee, had brought suit against the Auto Parts Mfg. Co. for infringement on patent No. 1,052,224. This broadly covers radiator bumpers which are attached to the frame with adjustable clamps, thus avoiding drilling of the frame side members.

Another patent upheld was that issued to D. McRa Livingston, No. 1,156,017, covering a mask for concealing the engine and radiator casing of a

AUTOMOBILE SHIPMENTS IN CARLOADS

Month	1916	1915	1914
January	18,054	8,369	11,114
February	21,502	11,273	10,572
March	28,600	16,442	13,117
April	28,000	17,112	14,122
May	24,000	13,642	12,405
June	23,879	15,325	8,617
July	18,079	12,517	5,605
August	18,254	16,959	9,612
September	21,660	18,940	12,209
October	19,510	17,848	12,003
November	17,250	17,138	7,710
December	—	15,582	7,378

Ford car. The patent permits of a combination hood and radiator mask which gives a distinctive stream-line effect.

Several patents are now before the courts, one being the Springfield type body. The suit is against the Fisher Body, charging infringement of design patents, Nos. 47,252 and 47,630, covering the Springfield type of convertible and four-door bodies.

Exports Pass $100,000,000

Automobile, truck and accessory exports this year have far passed the $100,000,000 mark. The wonderful showing the United States has made in the shipment of automobiles to foreign countries is reflected in the figures for the first ten months, a total of 67,616 cars and trucks, valued at $100,147,636, compared with 53,380 cars and trucks, and $94,434,432 in the same period in 1915, the war being the potent factor in this growth. Notwithstanding the restrictions made by Great Britain, Italy and France on the importation of our cars and trucks, the export figures have increased each month. Foreign markets, formerly supplied by Europe, have been developed, and the United States is fast getting a foothold which is not only continuing, but will mean increased sales after the war has stopped. South America is developing as an automobile field, shipping conditions are being bettered, and better credit relations are being opened. Australia, which for the past two years has been a large buyer of American cars, bought more of our cars and parts this year than ever before. British South Africa has prospered greatly because of the war, and here purchases of our automobiles and accessories have greatly increased. The West Indies have developed much as automobile consumers during the past year.

Automobile and commercial vehicle exports are now receiving more attention by the makers. A majority of them are building their cars with larger treads and with right or left steering, according to the demand from the specific locality. Special representatives are being sent to different parts of the world to study conditions and the American makers are fast taking advantage of the openings for increased trade caused by the war.

Truck exports during the year have not been as large as in 1915, but passenger car exports have averaged about 1000 more each month over the corresponding month of 1915. Truck exports have been lower since April. The American automobile, especially the medium and low-priced models, have proved popular in foreign countries, especially those not now engaged in war. These countries are sending men to the United States to investigate the automobile industry and ultimately to open agencies in their own countries.

More combinations of business interests in the automobile field have been made this year than ever before. Nearly twenty new companies have resulted from mergers, affecting fifty concerns. One of the large mergers during the early part of the year was the formation of the United Motors Corp., with a capital of $60,000,000, including at that time five of the largest parts and accessory making concerns. It has since merged four more concerns. Another important merger was that of the Motor Products Corp., a combination of five parts makers from the Detroit territory. Then came another merger of parts companies into the Steel Products Co., Detroit. In order to concentrate production, the Signal Motor Truck Co. and the Commerce Motor Car Co., Detroit, effected a merger, known as the Signal-Commerce Motor Truck Co.

Another consolidation was that of the Perfection Spring Co. and the Standard Welding Co. into the Standard Parts Co., Cleveland, capitalized at $35,000,000. This merger was important in that it eliminated the friction regarding the Perlman rim patents, as the Standard Parts Co. had contracts with the Perlman interests, permitting manufacture of demountable rims at a fair profit.

Monster Merger Plan

So far there has been no combination of the automobile companies, the nearest to that being the monster merger planned in June. According to plans, there was to be a capitalization of $223,000,000, and was to include Overland, Hudson, Chalmers, Auto-Lite and the United Motors. If the plans had not miscarried, this combination would have ranked in magnitude second only to the U. S. Steel company.

On account of the record output of the automobile and allied plants, the year 1916 has been one of large factory expansion, and, as a result, many of the companies were induced to refinance or reorganize. Others have added considerably to their capital, to take care of needed factory additions.

Thirty-Six New Companies

That the need for new capital has been well distributed is indicated by the fact that of thirty-six companies, which have refinanced and changed their names or reorganized, thirteen were automobile producers, seventeen accessory makers, and six truck manufacturers.

The large demand for the American automobiles and accessories was responsible for the formation of many new companies this year. Out of an approximate total of 130, a large majority of these companies have finished their organization work and have started the erection of plants. Some of them are producing, despite the shortage of machinery and the high cost of materials. New automobiles and many new accessories have been put on the market, and are finding a big demand.

During the year many men, formerly connected with the automobile industry, branched out for themselves by forming new companies. One of these companies, and one which is now producing, is the Jordan Motor Car Co., Cleveland, maker of the Jordan automobile. E. S. Jordan, formerly secretary and general sales manager of the Thomas B. Jeffery Co., together with Paul Zens and R. S. Begg, were the organizers. Later came the organization of the Liberty Motor Car Co., by Percy Owen, formerly connected with the Saxon company in the capacity of vice-president and sales manager.

The Columbia Motors Co., Detroit, was another new company formed by men prominent in the automobile field. Both these men, J. G. Bayerline and W. L. Daly, were formerly connected with the King Motor Car Co.

The year 1916 was featured by the entrance of many notable outside manufacturers into the automobile field. One of the most prominent was the Brunswick-Balke-Collender Co., Muskegon, Mich., maker of billiard tables, bowling alley fixtures, etc. This firm has started the manufacture of tires. Another concern to enter the field was the Niles Car & Mfg. Co., Niles, Ohio, maker of railroad cars. This concern is now making ¾ to 1-ton and 2 to 2½-ton trucks. During the latter part of the year A. Howard, pioneer in the buggy business in Galion, Ohio, formed a company to produce an assembled car.

Many Big Dividends

Dividends this year have been frequent and large. A number of the makers have bought back certain issues of stock and a majority of them have put their stock on a higher dividend paying rate. One of the largest dividend payments of the year was that of the Diamond Mfg. Co., which declared a 300 per cent cash dividend as a result of the change of control at the time of being taken over by the Motor Products Co. Several of the companies declared large stock dividends, ranging from 50 to 108 per cent, the latter being given by the Haynes Automobile Co. Several of the automobile makers have put their stocks on an 8 per cent basis, one of the first being the Chandler Motor Co., Packard Motor Car Co., and the Pierce-Arrow Motor Car Co. The Maxwell Motor Co. inaugurated quarterly payments of $2.50 per share on its common, practically putting that stock on a 10 per cent basis.

This year has been featured by a general rise in automobile prices on account of the increase in the cost of materials. The year previous saw a general reduction in the list price of automobiles, due to improved factory machinery, conducive of a much larger production, and to a general reduction in material prices. As wages, rents, and nearly everything that goes into the manufacture of automobiles have risen, it is remarkable that the makers have held their increases on an average to so low a mark. That the accessory people have taken care of the future is proved by the fact that few have gone up in price; a small number have announced reductions. Prices on automobiles for 1917 will show increases ranging from $20 to $300.

During the first 6 months of 1916 a great many of the leading automobile manufacturers announced increases in price on their various models, but as these were the past season's models they are not included in the list appearing on page 1092, which is made up of the changes in price announced since July 1. During the past month there has been almost a landslide toward higher prices due to the greatly increased cost of the materials which enter into the construction of chassis, body, and every part of the car. In some cases, an example of which is Maxwell, the company announced a reduction in prices during the summer only to find that the increase in the cost of production did not permit of continuing at this figure, with the result that higher

AUTOMOBILE EXPORTS

	1914	1915	1916
January	2481 $2,174,392	1803 $1,313,153	4520 $3,044,995
February	3837 $2,378,494	2230 $1,785,330	5651 $4,063,429
March	3538 $2,984,915	2429 $1,958,302	5539 $3,726,939
April	3239 $2,760,478	3078 $2,804,741	6242 $4,998,350
May	3157 $2,857,601	4921 $3,971,483	6275 $4,069,690
June	1982 $1,870,882	4418 $4,785,998	4905 $3,416,396
July	1265 $1,143,419	4118 $3,835,347	5258 $3,663,563
August	385 $441,879	3839 $3,121,834	5254 $3,574.485
September	646 $597,904	4299 $3,215,459	3585 $2,819,405
October	732 $678,387	3479 $2,749,255	4880 $3,756,768
November	776 $634,659	3690 $2,791,507	....
December	1297 $998,698	3664 $2,710,758	....

TRUCK EXPORTS

	1914	1915	1916
January	45 $74,491	935 $2,545,527	1269 $3,416,818
February	57 $83,461	1002 $3,022,482	2063 $6,170,367
March	50 $63,932	1339 $4,725,563	1878 $4,909,179
April	52 $72,676	2267 $5,240,481	1790 $5,294,801
May	141 $236,383	2426 $6,583,912	1717 $4,357,238
June	90 $120,257	2990 $8,578,802	1416 $3,551,148
July	50 $106,400	2469 $6,803,001	1243 $3,062,670
August	66 $124,016	1614 $4,387,193	1565 $4,442,158
September	128 $294,288	2227 $5,882,255	1835 $4,442,158
October	672 $2,286,964	1596 $4,307,190	1144 $3,635,291
November	842 $2,244,518	1553 $3,837,307	....
December	1279 $3,387,729	1664 $3,920,533	....

Market Prices for Each Month of the Year 1916

Material	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.*
Aluminum, lb	.53	.57	.65	.58	.58	.63	.58	.58	.61	.65	.65	.63
Antimony, lb	.42½	.44	.44½	.40	.29½	.18½	.13	.13½	.11	.13	.14	.14¾
Beams and Channels, 100 lb	2.16	2.17	2.62	2.77	2.77	2.67	2.67	2.67	2.76	2.87	3.17	3.42
Bessemer steel, ton	32.00	34 00	45.00	45.00	45.00	42.00	40.00	45.00	45.00	45.00	52.50	55.00
Copper, Elec., lb	.25	.28½	.28½	.29½	.29¾	.26½	.26½	.28	.28½	.28½	35	.34
Copper, Lake, lb	25	28½	.28½	29½	.29¾	.26½	26½	.28	28½	.28½	35	.34
Gasoline, bbl	.22	.23	.24	.24	.24	.24	.24	.23	.22	.22	.22	.22
Lard oil, prime, gal	.94	.95	.95	.98	1.10	1.05	1.05	1.05	1.08	1.10	1.30	1.30
Lead, 100 lb	6.10	6.30	8.18	7.50	7.22½	6.88	6.35	6.70	7.00	7.05	7.30	7.63
Linseed oil, gal	.73	.75	.77	.76	.73	.65	.69	.72	.73	.88	.96	.93
Open-hearth steel, ton	33.00	35.00	45.00	45.00	42.00	42.00	42.00	45.00	45.00	45.00	52.50	55.00
Petroleum, bbl., Kans., crude	1.25	1.30	1.55	1.55	1.55	1.55	1.45	.90	.90	.90	.90	1.20
Petroleum, bbl., Pa., crude	2.25	2.35	2.60	2.60	2.60	2.60	2.60	2.30	2.30	2.60	2.60	2.75
Rubber, Fine Up-River, Para, lb.	.86	.76	.75	73	.68	.63½	.66	.68½	.72	.75	80	.79
Rubber, Ceylon, lb	.93	.91	.91	.82	.70	.62	.56	.57½	.60	.61	.70	.75
Tin, 110 lb	42.50	42.13	50.00	49.50	39.50	48.88	38.25	39.25	38.75	41.25	45.50	42.63
Tire Scrap, lb	.05¾	.06½	.06½	.06	05½	.05½	.05½	05¾	05¾	.06	.06½	06½

*To Dec. 18.

prices had to be announced. In the case of Maxwell, however, the new prices are still considerably lower than those in effect before July 1, so this case is an exception. Ford is the only other company which has lowered its prices during the past 6 months. There seems to be very little uniformity in the amount of increase made by the different manufacturers, doubtless due to the fact that each maker has his own individual problems to solve and finds conditions different at his factory from those to be found at other centers of production. As a rule the cars selling at under $1,000 have increased their prices anywhere from $10 to $50; cars selling from $1,000 to $2,000 adding from $50 to $300; and cars selling at $2,000 up, increasing their list from $300 to $600.

Automobile production far outstripped previous efforts. During the first half of the year, 754,902 automobiles were produced. This output of 6 months is little behind the entire output for 1915, which was 892,618. Ninety-nine factories were included in this 1916 figure, and of these 96 per cent being made in Michigan, Ohio and Indiana. During the first half of the year, Ford manufactured 298,000 cars, with Overland next with 94,477. In the year ending Aug. 1, Ford recorded a production of 533,921 cars, an increase of 225,708. Truck production for 1916 is estimated at 98,000

Shipments Break All Records

Shipments this year have been unparalleled, notwithstanding a freight car shortage, which for a time menaced the industry. Carload shipments passed the 1916 mark in the first 11 months, amounting to 249,755 carloads up to the end of November, as compared with 192,575 in the whole of 1915.

Many Concerns Refinanced

Prominent among those automobile producers which inaugurated extensive expansion policies by refinancing are: Chalmers Motor Co., taken over by the Chalmers Motor Corp., with a capital of 600,000 shares of no par value; National Motor Vehicle Co., Indianapolis, taken over by the National Motor Car & Vehicle Corp., with an offering of 53,000 shares at $42.50 per share; Pierce-Arrow Motor Car Co., Buffalo, taken over by the Pierce-Arrow Motor Car Corp., formed with 100,000 shares of 8 per cent convertible preferred and 250,000 shares of common without par value; Mitchell-Lewis Motor Car Co., Racine, Wis., taken over by the Mitchell Motors Co., with a capital consisting of 125,000 shares of common without par value; Thomas B. Jeffery Co., Kenosha, Wis., taken over by C. W. Nash, former president of the General Motors Co., and Lee, Higginson & Co., Boston, with the formation of the Nash Motors Co., capitalized at $24,999,500; Stutz Motor Car Co., Indianapolis, taken over by the Stutz Motor Car Co. of America, with a capital of 75,000 shares, no par value.

The Royal Equipment Co., Bridgeport, Conn., in order to take care of expansion, formed the Raybestos Co., with a $1,500,000 capital. Another prominent accessory concern to refinance was the Auto Crank Shaft Co., Detroit, taken over by the Automobile Crank Shaft Corp., with a stock issue of $250,000, divided into 2500 shares of 7 per cent cumulative preferred stock and 7500 shares of common of no par value. The Pennsylvania Rubber Co. was reincorporated with a capital of $6,000,000, increasing its capital $4,000,000. The Torbensen Axle Co., Cleveland, was formed to take over the Torbensen Gear & Axle Co., the new company having a capital of $1,000,000 preferred and $750,000 common. Late this year the Hess-Bright Mfg. Co. announced that controlling interest in its company had been purchased by a group of financial men, who also own a substantial interest in the S. K. F. Ball Bearing Co. The Hess-Bright manufacturing facilities are to be increased materially, though the two companies will be operated quite independently of each other.

One of the first of the truck companies to add new capital was the Republic Motor Truck Co., which incorporated with a capital of $1,312,500, divided into 72,500 shares, 62,500 without any par value, and 10,000 with a par of $1,000 a share. Another prominent truck maker to expand this year was the Gramm-Bernstein Co., which reorganized and increased its capital stock to $4,000,000, forming a new company under the name of the Gramm-Bernstein Motor Truck Co. The capital is composed of $3,000,000 common and $1,000,000 preferred. The reorganization plan of the International Motor Co., New York, was approved by the stockholders and creditors, and as a result the International Motor Truck Corp. was formed to carry on business with $7,372,790. Thus additional capital of $1,500,000 was raised, and the $2,881,000 notes maturing the first of November were obliterated. Another prominent concern, the Smith Form-A-Truck Co., in order to enlarge production, was taken over by Michaelis & Co. and banking associates, who formed the Smith Motor Truck Corp., with a capital of 20,000 shares of 8 per cent cumulative and convertible preferred stock, and 1,200,000 shares of common, par $10.

Accessory Companies Expand

As was expected, the accessory makers would need additional space during the year. Some of them took care of their increased facilities through the ordinary channels, others added capital, and still others were forced to follow the lead of the automobile makers, and refinance. Stromberg Carbureter Co., Chicago, was one of the first to refinance when it went under new control. The Stromberg Carbureter Co. of America was formed under the control of Allan A. Ryan & Co. and a syndicate of prominent banking interests in New York. The new company issued 50,000 shares of no par value. Another was the Empire Rubber & Tire Co., Trenton, which formed a new company, the Empire Tire & Rubber Co., capitalized at $1,500,000 preferred and $4,500,000 common. As a result of increased business, the A. O. Smith Co. was taken over by the A. O. Smith Corp., Milwaukee, with an offering of $3,000,000 preferred and 100,000 shares of common. The Kemco Electrical Mfg. Co., Cleveland, was reorganized with an entirely new ownership and personnel.

Factory additions were large as usual, there being 9,362,881 sq. ft. added by all the branches of the automobile industry, costing $9,449,065. Additional equipment cost $8,233,190, making a grand total of $17,682,255, as compared with $12,886,345 in 1915.

Welfare Work Progresses

More attention this year has been given to the betterment of working conditions. Club houses, athletic fields, etc., have been installed in a large number of the factories. Working conditions have been improved, labor-saving machinery installed, improved lighting arrangement, shorter hours and increased wages, all have worked toward bringing about a complete change for the better. Firestone Tire & Rubber Co. opened a large clubhouse for employees. Many other concerns added materially to their welfare work.

Another interesting development of the year has been the indorsement of the principles set forth by advocates of the Safety First movement, especially with regard to protecting the workers from bodily harm by machinery or accidents of any kind in yard and factory. Among the companies who have taken up this phase of the welfare work possibilities may be mentioned the Republic Rubber Co., which has recently installed devices for safeguarding its employees at every point throughout its plant and yards where danger might arise.

In addition to caring for the bodily safety of their workers, most of the leading automobile and accessory manufacturing concerns have devised plans of assisting employees in developing their economic welfare. Arrangements whereby a certain amount of each worker's earnings may be put in a savings fund or other similar institution regularly are common in nearly all the large factories, as are also co-operative plans providing for life and accident insurance as well as sick benefits. Clubhouses for employees provide entertainment, exercise and social recreation outside of working hours and in other ways the workers are cared for.

Engineering Development

There is no vast advance in design to chronicle, as was the case a year ago. The design of American cars was improved enormously during 1915, and 1916 has been a year devoted mainly to improving the methods of manufacture and cleaning up little details of design. The high spots of the 1917 cars are better lubrication, easier controls and steering, and still more comfortable bodies. The V-engine has made no great advance, the six and four hold about the same proportion that they exhibited last year.

Materials Are Better

The terribly difficult conditions of the markets and the greater stresses called into being by higher speed engines have together caused engineers to give more attention to materials. It has been neces-

DIVIDENDS DECLARED

Company and Nature of Dividend

H. H. Franklin Mfg. Co.—100 per cent stock dividend on common.
General Motors Co.—Common on 20 per cent basis.
Packard Motor Car Co.—10 per cent stock dividend on common and cash dividend of 1¾ per cent.
Studebaker Corp.—Quarterly of 1½ per cent and an extra of 1 per cent on common. Also regular 1¾ per cent on preferred. Common placed on 10 per cent basis in August.
Continental Motor Mfg. Co.—100 per cent stock dividend and 5 per cent on common.
Chandler Motor Car Co.—Stock on 8 per cent basis. Extra cash dividend of 1 per cent.
Hydraulic Pressed Steel Co.—50 per cent stock dividend.
Miller Rubber Co.—66⅔ per cent stock dividend on common.
Paige-Detroit Motor Car Co.—80 per cent stock dividend on May 24 and a 50 per cent stock dividend on Sept. 6.
Willys-Overland Co.—Common on 12 per cent basis. Extra stock dividend of 10 per cent.
Haynes Automobile Co.—Stock dividend of 108 per cent.
Maxwell Motor Co.—Common on 10 per cent basis. $7 a share on preferred and $6 a share on second preferred.
Bower Roller Bearing Co.—Quarterly of 15 per cent cash. Recommended stock dividend of 100 per cent to be approved by holders at January meeting.
Sparks-Withington Co.—2 per cent on common for 6 months; also 1¾ per cent on preferred.
White Motor Co.—$1 a share, placing stock on 8 per cent basis.
Four Wheel Drive Automobile Co.—Stock dividend of 100 per cent and cash dividend of 30 per cent.
Kelsey Wheel Co.—50 per cent stock dividend on common.
Auto Body Co.—200 per cent stock dividend and 5 per cent cash.
Firestone Tire & Rubber Co.—$4 a year on new common with a par value of $10.
Saxon Motor Car Co.—Stock on 7 per cent basis.

sary to discover means for doing without some of the higher grades; for instance, there has not been anything like enough tungsten to allow all those makers who wanted it to get a supply. In consequence we have now got some tungsten substitutes which are doing good service.

A feature of the year's engineering work, which must be mentioned, is the way in which several of the leading manufacturers have turned their attention to aircraft motors. Some openly and some behind locked doors have been working engines for airplanes, and there are now American motors as good as the best of the European ones in existence. They are hardly yet in production, but they will be next year.

Carburetion has, perforce, received much attention, owing to the increasing trouble with low-grade fuel, and manifold design has been modified also, the principal aims being to atomize the fuel more completely and keep it hot till it is actually ignited. Ignition has been featured by a general improvement in the construction of battery systems which are stronger and simpler. Transmission has not changed, though some new electric drives will be found at the shows. Frames are stronger and more rigid, and spring design is better, the attention this received in 1915 now bearing fruit.

In brief, the automobile of 1917 is just a bit better job all around than was the car of 1916. Its average price is a few dollars higher, but more than enough value is being given in return.

Materials Cost More

The material markets have played an important part in the activities of the automobile industry. Prices have reached record quotations on account of the large demand and the small supply. Steel prices have risen skyward, reaching $60 a ton in December, practically double the quotation in January. Copper is higher, beams and channels are much above their quotations of January.

Pennsylvania crude petroleum has risen to $2.60 per barrel, the highest price in its history. Gasoline has fluctuated throughout the year. When retail prices reached the 30-cent a gal. mark, Federal investigation resulted in a small decline. Prices are now above normal.

Rubber and cotton duck prices were higher, the latter rising from 50 to 96 cents a lb. Naturally automobile and tire prices went higher. Tire prices rose 15 to 20 per cent in the early year, and a similar increase is looked for in January.

The crude rubber market opened in a very unsatisfactory condition, with Para selling at 95 cents a lb. and Ceylon at $1.05. With the Suez Canal temporarily closed, and submarine warfare hampering shipments, prices rose to new heights. Cotton was at that time costly, and compounding ingredients were at prohibitive prices. Naturally with over 60 per cent of the crude rubber used coming from the Eest, and with an increased demand, a general rise was imperative.

These high crude rubber prices, however, were short-lived, for in February and March quantities of rubber scrap, notably automobile tires, came into the market. Under improved reclaiming processes this surplus became crude rubber, and proved one of the factors in driving the price down to a reasonably low figure. Prices gradually dropped from 73 cents for Para and 75 for Ceylon in February to 63 and 62 respectively in July. Ceylon reached 57 cents a lb. in August, and is a little higher at the present time. Para rose in October on account of an unusual drought on that river.

The Year in Speed Events

The year has been a 100 m.p.h. speedway era. All records on speedways and road have been broken, all transcontinental records have been shattered, and new marks in fuel economy have been made. In ten of the events, 100 m.p.h. or over was recorded. This year saw twenty-one finishers with an average of better than 100 m.p.h. in speedway races.

A new 24-hr. record was made by a Hudson Super-six, which traveled 1819 miles in that period, shattering the old record by 238 miles, made by Edge in a Napier at Brooklands.

A new transcontinental record was made by a Hudson, which covered the San Francisco-New York trip in 5 days, 3 hr., and 31 min., making the round trip in 10 days, 21 hr., and 3 min. The year witnessed three well-planned and executed attacks on the transcontinental mark. Cadillac opened the drive in May, cutting the old figure. 1 day and 14 hours. In July Marmon cut this figure by nearly 2 days, and lastly came the Hudson, establishing the present record.

Car Price Increases

Car	Change	Effective
Hudson	$175	Dec. 1
Maxwell	$60 lower on Tourer $55 lower on Roadster	July 1
Reo	$100 lower $75 lower on truck	Aug. 5
Dort	$30	Aug. 1
Ford	$35 to $95 lower	Aug. 1
Ross	$200	Sept. 1
Chevrolet	$50 on Baby Grand	Aug. 26
Daniels	$200	Sept. 1
Chalmers	$70 on 7-Tourer $90 on Sedan $70 on Town Car and Limousine	Dec. 1
Pullman	$85	Oct. 24
King	$50	Nov. 6
Cole	$100	Jan. 1, 1917
Packard	$185 on Model 225 $235 on Model 235	Feb. 1, 1917
Marmon	$150	Jan. 1, 1917
Kissel	$90 to $115	Dec. 1
McFarlan	$300	Dec 1
Chase Truck	$75	Nov. 27
Riker Truck	$100	Dec. 1
Winton	$200	Dec. 15
Saxon	$50	Jan. 1, 1917
Premier	$200 to $215	Dec. 1
Allen	$100 on Closed Cars	Jan. 1, 1917
Mitchell	$100	Dec. 1
Cadillac	$160	Dec. 14
Mack Truck	$100 to $250	Jan. 1, 1917
Austin	$350 to $600	Dec. 11
Buick	$10 Model D-4-34 and D-4-35 $55 Model D-6-44 $50 Model D-6-45 $15 Model D-6-46 $35 Model D-6-47	Jan. 15, 1917 Jan. 15, 1917
Maxwell	$40 Touring Model and Roadster	Jan. 1, 1917
Franklin	$100 all models	Mar. 1, 1917
Standard	$100 all models	Jan. 1, 1917
Auburn	$60 Model Six	Jan. 1, 1917
King	$185 seven and four-passenger touring cars and roadster $200 on seven-passenger sedan	Dec. 19, 1916
Stanley	$225 five-passenger and seven-passenger touring $250 seven-passenger sedan	Dec. 4, 1916
Paige	$120 on Model 51 Stratford $85 on Model 39 Linwood $105	Dec. 19, 1916

S. A. E. Adds 36 Standards in Year

1916 Proves Epochal Period in Society's Development—Horizon Widens with New Year

On many occasions when writing of the Society of Automobile Engineers its immensely rapid progress has been the theme. Year by year, it seems, the pace increases, and 1916 has been more important to the S. A. E. than any which have gone before. In fact it has actually been an epochal year for the society, for it has seen the S. A. E. make its way forward till it stood among the leading engineering societies of the world 2 years and more ago. In 1916 it has amalgamated with the aeronautic engineers and it is extending its activities to care, in a specialized way, for tractor and marine motor engineering.

Probably the biggest factor in bringing to pass the broadening of the society's scope is the work of standardization accomplished by the S. A. E. in the automobile field and the obviousness of the immense amount to be done in the other allied industries. That of the aeroplane has already been begun and new divisions of the standards committee will soon spring into being to look after the other departments.

As the outward and visible sign of the society's growing activities is the change of name to Society of Automotive Engineers, which will certainly be ratified at the January meeting of 1917. From the automobile industry, the aeroplane, tractor and motor boat industries have branched out and automotive is a peculiarly happy word to express the wide field they cover. Previously there has been no one word which could be used in a generic sense to cover all these new allied industries. We are now provided with one and it is likely that automotive engineering will be used in the way it is intended throughout the English-speaking world.

The enlargement is being accompanied by a substantial increase in membership, and the total of 2121, 317 more than on Jan. 1, 1916, at which the society now stands will certainly be much increased very soon. Not only is the broadening of scope bringing in many members, but it is bringing keen men, enthusiasts in their subject, into the organization. The newer branches of the automotive industry have been created by the most active and most persevering types of men, men who will use the opportunities of membership to the full.

Immense Growth of Sections

There is no better index to the much greater use which the membership is making of the advantages of membership than the amazing change that has taken place in the character of the meetings of the sections. Two years ago the Detroit section met in a small room; to-day it uses the largest gathering place in the city and shows attendance at papers and discussions equal to, or even greater than the near 700 members of the section. Cleveland has shown similar growth, the rise of the new section being even more rapid, though it has not yet reached Detroit's totals. The Metropolitan section has had better gatherings than ever, while the Mid-West section at Chicago and the Pennsylvania at Philadelphia are growing healthily. Within the past month the Buffalo section has been created, and bids fair to be soon among the largest, if the meeting for its formation may be taken as any indication. Buffalo now having so many aeronautic engineers at work within it is likely to be a place where papers and discussions on this phase of automotive engineering will be common.

Giving the figures in order of magnitude, Detroit has 710, of which 361 are section associates; Cleveland has 268, of which 122 are section associates; the Metropolitan section has 235, sixteen being associates; the Mid-West has seventy-six, with twenty-six associates; Indiana has sixty-seven, fourteen being associates and Pennsylvania forty-five, with twenty-one associates. These associates are members of the sections only, and not members of the parent society, but it is probable that a majority of this 560 men may become so.

Standards Finally Accepted by S. A. E. in 1916

JANUARY MEETING

1—Instructions for testing materials and some now standard test specimens.
2—Cone clutch flywheel housing (bell housing).
3—Basis of speed and mileage rating for electric vehicles.
4—License plates and brackets.
5—Tire pump bases.
6—Location of chassis number.
7—Location of engine number.
8—Sizes of hose connections.
9—Lock washer dimensions.
10—Forms for specifications and methods for commercial testing of springs.
11—Sizes and specifications for insulated wires and cables.
12—Industrial truck tires.
13—Diameters of truck tires.
14—Dimensions of truck wheel felloe bands.
15—Standard weight definition.
16—Piston ring groove widths (part of final complete standard).
17—Location of slots in headlamp bulbs (revised later).
18—Resolution in favor of 42-in. rule for minimizing headlamp glare.

JUNE MEETING

19—Standard nomenclature.
20—Series of standard sizes of flexible metallic tubing.
21—Headlamp bracket dimensions.
22—Minimum height of headlamp above ground.
23—Resolution that current reducing dimmers are of no value for glare reduction.
24—Specification (partial) for focussing device.
25—Location of headlamp bulb slots.
26—Revision of bulb nomenclature.
27—Fitting and wiring of storage battery.
28—Throttle lever rod ends.
29—Throttle lever end throw.
30—Charging plug receptacles for electric vehicles.
31—Nickel steel.
32—New table of physical tests of several S. A. E. steels.
33—New test specimen recommendations.
34—Formula for and tabulation of sizes of piston ring grooves (final form).
35—Increase of length of thread on S. A. E. bolts.
36—Complete tabulation of taper roller bearing sizes.

The work of the standards committee is about to be reorganized, having now grown to such dimensions that the old system is developing weakness in places. During the year the committee divisions have mostly been very active and a number of difficult subjects have been disposed of. The actual number of new standards is not large, but those which have been accepted are mainly of a really useful character. In some respects the difficulty of getting agreement on standards increases just as the demand for them grows. Standards are now being worked out for things which a short while ago were declared unstandardizable, mainly because individuals who used to be jealous competitors have discovered the immense advantages of getting together.

In January K. W. Zimmerschied resigned the chairmanship of the standards committee having, in his time of office, stimulated the work to an enormous extent and by constant personal appeal, spread the standardization idea far and wide. With the appointment of A. Ludlow Clayden, the chairman for 1916, several divisions were discontinued and such work as they had unfinished turned over to other divisions. At later dates there were created the tire and rim division, which is now proceeding rapidly with the standardization of pneumatic tires and

rims under the chairmanship of K. W. Zimmerschied; and the aeronautic engine division, Chairman Henry Souther, which has a hard task before it in getting order from the present chaos of aeroplane engine detail. Also the nomenclature committee was created a regular division, also under Mr. Zimmerschied's chairmanship.

Standard nomenclature for every part of an automobile chassis was accepted by the society at the summer meeting and an illustrated book containing all the names will probably be published in the spring of 1917.

Three meetings of the standards committee have been held, one in April at Cleveland; the second at the summer meeting on the Noronic and the third at the Bureau of Standards, Washington, in October. The standards accepted at the summer meeting are listed on this page and a number of others will be submitted to the January meeting for acceptance

Throughout the year the electrical equipment division has been concerned mainly with matters relating to lamp standardization and headlamp glare and much useful detail work has been done, though there has been no settlement of the glare problem in the form of a general resolution.

The truck standards division has been reorganized as to personnel now being composed entirely of engineers from truck factories under the chairmanship of H. D. Church. The division has been mainly concerned with military specifications and has been in close touch with Washington on this subject. Its most important accomplishment is the formulation of a standard control which will come up for acceptance in January.

The big work of the engine and transmission division has been the revision of the engine test forms which is now just finished, and another important work nearing completion is a standard for generator and starting motor mounting, this being handled by a sub-committee of both the engine and transmission and the electrical equipment divisions.

The miscellaneous division has completed its piston ring groove standardization, has examined with great care and finally reported as impossible, a standard speedometer drive and has several recommendations for the January meeting. Steering wheel hub standards, taper fittings for such things as fender irons, fine pitch threads and a number of other similar matters are in an advanced stage.

The ball and roller bearing, the iron and steel and the electric vehicle divisions have proceeded steadily and have several new standards to their credit. The springs division, which presented a voluminous report last January, has recently completed some additions, principally relating to spring bolts and spring clips which are nearly ready for acceptance. The research division has devoted the whole year to the perfection of the recommended form of procedure for testing a car for fuel economy and acceleration. Some tests of the system have been made and further tests are to be made.

Automobile Securities Quotations Range Throughout the Year 1916

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Ajax Rubber Co.	71¼	71	68½	66	66	64	64	64	64½	63	70
J. I. Case T. M. Co.	86	85	75	86	86	86	83½	82	82	84¼	87
Chalmers Motor Co. com	120	130	158	150	160	•160	175	150	145	100	134
Chalmers Motor Co. pfd.	100	99	99	97	96	99	98	98	96	90	111
Chandler Motor Car Co	.....	.....	.....	.....	96½	108	107½	103	105	106	172
Chevrolet Motor Co.	132	134	164	178	231	214	216	197	204	197	172
Fisher Body Corp.	.....	.....	.....	.....	.....	.....	.....	39¼	40¼	40	38
Fisk Rubber Co. com	.....	.....	.....	.....	.....	.....	160	150	100	100	80
Fisk Rubber Co. 1st pfd	.....	.....	.....	.....	.....	.....	114	114	110	110	100
Fisk Rubber Co. 2nd pfd	.....	.....	.....	.....	.....	.....	120	120	100	100	90
Firestone Tire & Rubber Co. com	730	735	745	800	830	880	915	1000	1050	1130	168
Firestone Tire & Rubber Co. pfd	112	112	113	114	113	112	111	112	110	110	106
General Motors Co. com	486	477	480	400	431	470	480	525	700	830	510
General Motors Co. pfd	112	114	113	111½	116½	112½	110½	121½	124	126½	120
B. F. Goodrich Co. com	71⅛	72¾	72½	73½	75¾	73	73⅛	71¾	72¾	74¼	70½
B. F. Goodrich Co. pfd.	110	113	114	114	115	113½	113	113⅛	112	114⅛	113½
Goodyear Tire & Rubber Co. com	338	342	340	405	380	230	225	240	270	296	294
Goodyear Tire & Rubber Co. pfd	114	116	112	116	105	106½	106	106¾	106½	108	106½
Grant Motor Car Corp	.....	.....	.....	.....	11	9	9	7	8	8	8
Hupp Motor Car Corp. com	.....	.....	.....	.....	.....	.....	6½	6½	6	5	4
Hupp Motor Car Corp. pfd	.....	.....	.....	.....	.....	.....	80	80	80	90	80
International Motor Co. com	23	22	20	10	10	12	5	6	5	4½	5
International Motor Co. pfd	38	35	35	20	22	18	17	15	15	17½	23
Kelly-Springfield Tire Co. com	74⅛	71	74½	68	74	69	70¼	73¾	83	78¾	76¼
Kelly-Springfield Tire Co. pfd	86	95	96	95	96	95	96	95	98	98	96
Kelsey-Wheeler, com	.....	.....	.....	.....	.....	.....	60	60	60	60	55
Kelsey-Wheeler, pfd	.....	.....	.....	.....	.....	.....	100	100	100	100	100
Keystone Tire & Rubber Co. com	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15¾
Keystone Tire & Rubber Co. pfd	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15¼
Lee Rubber & Tire Corp	.....	.....	.....	.....	.....	.....	45	44	45¾	42¾	38¾
Maxwell Motor Co. com	66½	65¼	69	69½	86	80⅛	81½	82½	96	89¾	74
Maxwell Motor Co. 1st pfd	88¼	86	85	77	88½	85	87½	85	87½	87	81¾
Maxwell Motor Co. 2nd pfd	53	49¾	54	50	57½	54	57¾	54¾	58	55½	49½
Miller Rubber Co. com.	260	275	235	265	300	300	200	220	250	250	255
Miller Rubber Co. pfd	113	113½	112	113½	115	115	104	105	104	105	107
Mitchell Motors Co.	.....	.....	.....	.....	.....	.....	67	66	66	64	59
Packard Motor Car Co. com	162½	170	160	165	204	190	168	165	150	170	173
Packard Motor Car Co. pfd	102	102	100	100	100	100	100	100	95	95	101
National Auto Corp	.....	.....	.....	.....	.....	.....	.....	.....	.....	42¾	40¾
Paige-Detroit Motor Car Co	710	665	690	750	980	45	45	46	32	36¾	38
Peerless Truck & Motor Corp	38½	26	26	20	20	24	23	24½	26	24	25
Portage Rubber Co. com	70	65	70	75	85	85	113	150	160	174	165
Portage Rubber Co. pfd	102	107	106	108	107½	107½	115	150	160	173	173
Regal Motor Car Co. pfd	11½	13	10	20	20	20	17	17	18	17	25
Reo Motor Car Co	25	27¼	26	28¼	37	37¼	37¼	36	43½	43¼	45½
Reo Motor Truck Co	32	34	33½	38	44½	40½	43½	43¼	44½	.....	.....
A. O. Smith Corp.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43
A. O. Smith Corp	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	96½
Saxon Motor Car Corp	.....	.....	.....	.....	73½	78	75	72	82	80	78
Spicer Mfg. Co.	.....	.....	.....	.....	.....	.....	.....	.....	.....	101½	47¼
Springfield Body Corp. com	.....	.....	.....	.....	.....	.....	77	84¾	82	92	90
Springfield Body Corp. pfd	.....	.....	.....	.....	.....	.....	120	120	120	120	120
Smith Motor Truck Co.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6¾
Stewart Warner Speedometer Corp. com	88	86½	87	84¼	88	96½	103	117	112½	113	106
Stewart Warner Speedometer Corp. pfd	108	108	109	109	109	109	109	100	109	109	109
Studebaker Corp. com	153¾	146	141	120	137¼	137½	126½	125¼	130¼	135	124
Studebaker Corp. pfd	110	109	111	108	109	107	109	107½	107⅛	111	109¼
Stutz Motor	.....	.....	.....	.....	.....	58	62¾	65	65	68	65
Stromberg	.....	.....	.....	.....	.....	.....	42	42¼	42	42	42
Swinehart Tire & Rubber Co	87	87½	88	84	83	83	85	95	90	86	85
United Motors Corp.	.....	.....	.....	.....	68½	60½	69	60½	67¼	66⅝	61½
U. S. Rubber Co. com	54½	51¾	52¼	50½	51¾	52	63⅛	56½	59	61	65¾
U. S. Rubber Co. pfd.	107¼	106	109	106	109	108½	108	111⅛	113	111½	112½
White Motor Co	49½	49¾	51	49½	51½	53	54	53⅛	54¼	57	54
Willys-Overland Co. com	221	208	229	210	259	277	60½	46	45⅛	46⅛	38¼
Willys-Overland Co. pfd.	110	104	104	102½	106	106¼	105⅛	104¼	102¾	103	98⅛

Financing a Feature of the Year

Many New Companies Formed, Important Mergers Consummated and Rearrangement of Finances Effected

New Companies

A. B. C. Starter Co., Detroit, Mich. Capital $150,000—A. B. C. Ford starter—Jan.

Jordan Motor Car Co., Cleveland, Ohio. Capital, $800,000—Jordan cars—Jan.

Liberty Motor Car Co., Detroit, Mich. Capital, $400,000—Liberty car—Feb.

Harding Motor Car Co., Cleveland, Ohio. Harding Twelve—Jan.

Columbia Motors Co., Detroit, Mich. Columbia car—Feb.

American Motors Corp., Plainfield, N. J. Capital, $1,250,000—American car—Feb.

States Motor Car Mfg. Co., Kalamazoo, Mich. Capital, $600,000—States car—Feb.

Castaluminum Body Co., Detroit, Mich. Capital, $100,000—Aluminum bodies—March.

Fergus Motors of America, New York. Capital, $2,000,000—Fergus car—March.

Roto Motor Co., Hannibal, Mo. Capital, $350,000—Roto truck—March.

Twin City Four Wheel Drive Mfg. Co., St. Paul, Minn. Capital, $1,000,000—Trucks—March.

Perlman Rim Corp., New York. Capital, $10,000,000—Demountable rims—March.

Covert Gear Co., Lockport, N. Y. Capital, $1,000,000—Trucks and tractors—April.

Union Tire & Rubber Co., St. Louis, Mo Capital, $500,000—Tires—March.

Premier Motor Corp., Indianapolis, Ind. Capital, $2,500,000—Premier car—April.

Bournonville Motors Corp., New York. Bournonville rotary valve motors—April.

Day-Elder Motors Co., Newark, N .J. Capital, $100,000—Day-Elder trucks—April.

J. & D. Tire & Rubber Co., Charlotte, N. C. Capital, $500,000—J. & D. tires—April.

Kerosene Carbureter Co., Pittsburgh, Pa. Harroun kerosene carbureter—April.

Ohio Gas Generator Co., Columbus, Ohio. Webber kerosene vaporizer—April.

Warner Lens Co., Chicago, Ill. Warner glass lens—April.

United Motor Fuel Corp., New York. Capital, $25,000—Gasoline—April.

Essex Motor Truck Co., New York. Capital, $600,000—Ranier truck—June.

S. S. E. Co., Philadelphia, Pa. Capital, $5,000,000—S. S. E. car—June.

Comet Automobile Co., Rockford, Ill. Capital, $1,000,000—Comet car—June.

Higrade Motors Co., Buffalo, N. Y. Capital, $250,000—Higrade truck—June.

Gillette Motor Co., Mishawaka, Ind. Wilmo rotating sleeve motor—July.

Aland Motor Car Co., Detroit, Mich. Capital, $500,000—Aland car—July.

Nash Motors Co., Kenosha, Wis. Capital, $24,999,500—Jeffery car—July.

Enger Motor Car Co., Cincinnati, Ohio. Capital, $4,000,000—Enger car—Aug.

Phianna Motor Co., Newark, N. J. Capital, $500,000—Phianna car—Aug.

General Engineering Co., Detroit, Mich Capital, $200,000—Doble steamer—Aug

Metropolitan Motors, Inc., New York. Capital, $1,000,000—White Star truck—Aug

Westgard Tire & Rubber Co., Warren, Ohio. Capital, $1,500,000—Westgard tire—Aug.

Parker Collapsible Rim Corp., Cleveland, Ohio. Capital, $500,000—Rims—Aug.

Iowa Rubber Tire Co., Davenport, Iowa. Capital, $1,000,000—Tires—Aug.

A. Howard Co., Galion, Ohio. Capital, $500,000—Howard car—Sept.

Auto Crank Shaft Corp., Detroit, Mich. Capital, $1,000,000—Crankshafts—Oct.

Kent Motors Corp., Newark, N. J. Kent car—Sept.

Budd Wheel Corp., Philadelphia, Pa. Capital, $2,000,000—Steel and wire wheels—Oct.

Union Products Co., Rockford, Ill. Capital, $200,000—Parts and accessories—Sept.

Eastern Motors Syndicate, Hartford, Conn. Charter Oak car—Oct.

Harroun Motor Corp., Detroit, Mich. Capital, $10,000,000—Harroun car—Sept.

Cook Attachment Patents, Inc., New York. Capital, $10,000—Issues licenses on Cook patents—Sept.

United Truck & Equipment Co., Detroit, Mich. Capital, $400,000—to operate United Motor Truck Co.—Oct.

Olympian Motors Co., Pontiac, Mich. Capital, $1,000,000—Olympian car—Oct.

Pilgrim Motor Co., Portland, Me. Capital, $750,000—Pilgrim car—Oct.

Emerson Motors Co., New York. Capital, $10,000,000—Emerson car—April.

Dey Electric Corp., New York. Steinmetz electric car—Nov.

Lozier Bros. Co., Cleveland, Ohio. Capital, $10,000,000—Automobiles—Nov.

Brunswick M. C. Co., Newark, N. J. Capital, $500,000—Brunswick car—Nov.

Sterling Automobile Mfg. Co., Bridgeport, Conn. Ams—Sterling car—Nov.

Winther Motor Truck Co., Kenosha, Wis. Capital, $330,000—Winther truck—Nov.

Ball & Ball Carbureter Co., Detroit, Mich. Capital, $20,000—Ball & Ball carbureter—Nov.

A. C. Axle Mfg. Co., Philadelphia, Pa. Capital, $1,000,000—Compensating driving axle—Nov.

Electro-Pneumatic Gearshift Corp., Pittsburgh, Pa. Electro-pneumatic gearshift—Dec.

Duryea Motors, Inc., Wilkes-Barre, Pa. Capital, $4,000,000—Duryea Gem—Dec.

Rahan Co., Detroit, Mich. Capital, $100,000—Ford starters—Dec.

Refinancing

Stutz Motor Car Co. of America, Indianapolis, Ind. (old name Stutz Motor Car Co.). Capital, 125,000 shares, n.p.v.

Mitchell Motors Co., Racine, Wis. (old name Mitchell-Lewis Motor Co.). Capital, 125,000 shares, n.p.v.

Scripps-Booth Co., Detroit, Mich., reorganized. Capital, $1,000,000.

Portage Rubber Co., Barberton, Ohio. Capital increased from $1,250,000 to $3,000,000.

Stromberg Carbureter Co of America, Chicago, Ill. (old name Stromberg Motor Devices Co.). Capital increased from $50,000 to $5,000,000.

Republic Motor Truck Co., Alma, Mich. Capital increased from $852,219.98 to $1,312,500.

Redden Motor Truck Co., Detroit, Mich. Recapitalized at $500,000.

Enger Motor Car Co., Cincinnati, Ohio (old name Frank J. Enger Co.). Capital, $4,000,000, divided into $1,000,000 7 per cent pref. and $3,000,000 common.

Alliance Tire Co., Alliance, Ohio. Capital increased from $150,000 to $650,000.

Pennsylvania Rubber Co., Jeannette, Pa. Reincorporated with capital of $6,000,000. Previous capital $2,000,000.

Polack Truck Tyre Corp., Bridgeport, Conn. (old name Polack Tyre & Rubber Co.). Capital, 100,000 shares, n.p.v.

Abbott Corporation, Detroit, Mich. (old name Consolidated Car Co.). Capital increased from $500,000 to $1,250,000.

Torbenson Axle Co., Cleveland, Ohio (old name Torbenson Gear & Axle Co.). Capital, $1,750,000, divided into $1,000,000 preferred and $750,000 common.

McFarlan Motor Corp., Connersville, Ind. (old name McFarlan Motor Co.). Capital, $3,000,000.

General Motors Corp., New York (old name General Motors Co.) Capital, $102,600,000, divided into $82,600,000 common and $20,000,000 non-voting preferred. Preferred is 6 per cent cumulative.

Winton Co., Cleveland, Ohio. Capital issue of $1,500,000 7 per cent cumulative preferred.

Gramm-Bernstein Motor Truck Co., Lima, Ohio (old name Gramm-Bernstein Co.). Capital, $4,000,000, divided into $3,000,000 common and $1,000000 preferred.

Firestone Tire & Rubber Co., Akron, Ohio. Sale of $5,000,000 new preferred at 6 per cent.

Star Rubber Co., Akron, Ohio, reorganized. Capital increased from $200,000 to $400,000 preferred.

Fisk Rubber Co., Chicopee Falls, Mass. Capital increased from $15,000,000 to $39,500,000. New capital, $7,500,000 first preferred, $5,000000 second preferred, $12,000,000 common.

Hydraulic Pressed Steel Co., Cleveland, Ohio. Issue of $1,000,000 7 per cent cumulative preferred.

National Motor Car & Vehicle Corp., Indianapolis, Ind. (old name National Motor Vehicle Co.). Capital, 53,000 shares at $42.50 per share.

Raybestos Co., Bridgeport, Conn. (old name Royal Equipment Co.). Capital, $1,500,000.

Manhattan Electrical Supply Co., New York (no change in name). Capital, $5,000,000. First preferred, $1,500,000, 7 per cent cumulative. Second preferred, $500,000, 7 per cent cumulative. Common, $3,000,000.

International Motor Truck Corp., New York (former name International Motors Co.). Capital, $7,372,790. 71,043 shares, p.v. $100. 53,638 shares n.p.v.

Pierce-Arrow Motor Car Corp., Buffalo, N. Y. (old name Pierce-Arrow Motor Car Co.). Capital, 100,000 shares 8 per cent convertible preferred. 250,000 shares of common, n.p.v.

Monitor Motor Car Co., Columbus, Ohio (old name Cummins-Monitor Co.). Capital, $10,000.

Emil Grossman Mfg. Corp., New York (no change in name). Capital, $320,000. First preferred, $150,000. Second preferred, $160,000. Common, 10,000 shares, n.p.v.

Smith Motor Truck Corp., Chicago, Ill. (old name Smith Form-A-Truck Co).. Capital, 20,000 shares of 8 per cent cumulative and convertible preferred; 1,200,000 shares of common, p.v. $10.

Duplex Truck Co., Lansing, Mich. (old name Duplex Power Car Co.). Capital, $1,000,000.

Empire Tire & Rubber Corp., Trenton, N. J. (old name Empire Rubber & Tire Corp.). Capital, $6,000,000. Preferred, $1,500,000 7 per cent cumulative convertible. Common, $4,500,000, common p.v. $10.

Knickerbocker Motors, New York (old name Knickerbocker Motor Truck Mfg. Co.). Capital, $500,000 all common, p.v. $10.

Kokomo Tire Co., Kokomo, Ind. (old name Kokomo Rubber Co.). Capital, 100,000 shares, n.p.v.

Four Wheel Drive Automobile Co., Clintonville, Wis. Capital increased from $250,000 to $500,000.

Kelsey Wheel Co., Detroit, Mich. Capital increased from $1,000,000 to $1,500,000.

Ogren Motor Works, Waukegan, Ill. (old name Ogren Motor Car Co.). Capital, $1,000,000, from $25,000.

Sparks-Withington Co., Jackson, Mich. Capital increased from $300,000 to $1,000,000.

M. & S. Gear Co., Detroit, Mich. Capital increased from $1,000,000 to $1,750,000.

Hurlburt Motor Truck Co., New York. Capital increased from $150,000 to $450,000. $350,000 7 per cent preferred; $100,000 common.

Lancaster Tire & Rubber Co., Lancaster, Ohio (old name Midgley Tire & Rubber Co.). Capital increased from $550,000 to $850,000.

Goodyear Tire & Rubber Co., Akron, Ohio. Capital increased to $50,000,000. $25,000,000 preferred; $25,000,000 common.

Packard Motor Car Co., Detroit, Mich. Capital increased to $21,000,000. Preferred, $8,000,000; common, $21,000,000

Garford Motor Truck Co., Lima, Ohio. Capital increased to $5,000,000. Common, $2,500,000; preferred, $2,500,000.

Autocar Co., Ardmore, Pa. Capital increased from $300,000 to $1,800,000.

Auto Body Co., Lansing, Mich. Capital increased from $500,000 to $1,000,000.

Republic Motor Truck Co., Alma, Mich. Capital increased from $250,000 to $1,000,000.

Elgin Motor Car Corp., Chicago, Ill., Capital increased from $1,000,000 to $3,500,000.

McCord Mfg. Co., Detroit, Mich. Capital increased from $1,000,000 to $2,500,000.

Cadillac Auto Truck Co., Cadillac, Mich. Capital increased from $100,000 to $200,000.

Willys-Overland Co., Toledo, Ohio. Capital increased from $25,000,000 to $75,000,000. $50,000,000 common. $25,000,000 pref.

Wyman & Gordon Co., Worcester, Mass. (no change in name). Capital increased to $3,000,000.

Mergers

Motor Products Corp., Detroit, Mich.
  Includes: Rands Mfg. Co., Detroit.

Vanguard Mfg. Co., Detroit.
    Diamond Mfg. Co., Detroit.
    Universal Metal Co., Detroit.
    Superior Mfg. Co., Ann Arbor, Mich.
  Capital—100,000 shares, n.p.v.

Fisher Body Corp., Detroit, Mich.
  Includes: Fisher Body Co., Detroit.
    Fisher Closed Body Co., Detroit.
    Fisher Body Co. of Canada, Ltd., Walkerville, Ont.
  Capital—$5,000,000 7 per cent cumulative pref. 200,000 shares, n.p.v.

Elgin Motor Car Corp., Chicago, Ill.
  Includes: New Era Motor Car Co., Joliet, Ill.

Willys-Overland, Ltd., Toronto, Ont.
  Includes: Willys-Overland of Canada, Toronto.
    Russell Motor Car Co., Toronto.

Edmunds & Jones Corp., Detroit, Mich.
  Includes: Edmunds & Jones Mfg. Co., Detroit.
    Canadian Lamp & Stamping Co.
    Chicago Electric Mfg. Co., Chicago.
  Capital—$1,000,000 of 7 per cent pref., 5000 shares of common.

Corcoran-Victor Co., Cincinnati, Ohio.
  Includes: Corcoran Lamp Co., Cincinnati.
    Victor Lamp Co., Cincinnati.
    Victor Auto Parts Co., Cincinnati.
  Capital—$2,250,000. $750,000 pref. $1,500,000 common.

United Motors Corp., New York.
  Includes: Perlman Rim Corp., New York and Jackson, Mich.
    Dayton Engineering Laboratories Co., Dayton, Ohio.
    Remy Electric Co., Anderson, Ind.
    Hyatt Roller Bearing Co., Newark, N. J.
    New Departure Mfg. Co., Bristol, Conn.
    Lovell-McConnell Mfg. Co., Newark, N. J.
    Harrison Radiator Corp., Lockport, N. Y.
    Houk Mfg. Co., Buffalo.
    Brown-Lipe-Chapin Co., Syracuse, N. Y.
  Capital—1,200,000 shares n.p.v.

Steel Products Co., Cleveland, Ohio.
  Includes: Steel Products Co., Cleveland.
    Michigan Electric Welding Co., Detroit.
    Metals Welding Co., Cleveland.
  Capital—$4,000,000.

Signal-Commerce Motor Truck Co., Detroit, Mich.
  Includes: Signal Motor Truck Co., Detroit.
    Commerce Motor Car Co., Detroit.
  Capital—600,000 shares, n.p.v.

Kelsey Wheel Co., Detroit, Mich.
  Includes: Kelsey Wheel Co., Detroit.
    Kelsey Wheel Co., Windsor, Ont.
    Herbert Mfg. Co., Detroit.
  Capital—$13,000,000. Pref., $3,000,000 7 per cent cumulative. Common, $10,000,000.

H. J. Koehler Motors Corp., Newark, N. J.
  Includes: H. J. Koehler S. G. Co., Newark.
    L. E. Schlotterback Mfg. Co., Newark.
  Capital—$425,000.

Perfection Tire & Rubber Co., Chicago, Ill.
  Includes: Perfection Tire & Rubber Co., Fort Madison.
    Perfection Tire & Rubber Co., Ltd.
    Champion Auto & Equipment Co.

Velie Motors Corp., Moline, Ill.
  Includes: Velie Motor Vehicle Co., Moline.
    Velie Engineering Co., Moline.
  Capital—$2,000,000.

Standard Parts Co., Cleveland, Ohio.
  Includes: Perfection Spring Co., Cleveland.
    Standard Welding Co., Cleveland.
  Capital—$35,000,000. Pref., $10,000,000 7 per cent cumulative. Common, $25,000,000.

Automobile Registrations for First 6 Months of Past 5 Years

State or Territory	1912	1913	1914	1915	1916
Alabama	3,970	5,170	7,500	11,800	19,977
Arizona	2,085	1,037	4,104	5,426	9,743
Arkansas	3,366	3,000	4,695	7,200	12,300
California	78,603	108,156	107,173	138,600	187,519
Colorado	11,083	9,300	16,500	21,588	38,000
Connecticut	15,400	19,005	24,530	34,199	45,731
Delaware	1,780	2,118	2,608	4,135	5,438
District of Columbia	10,000	10,829	14,964	8,500	5,268
Florida	4,964	8,361	9,578	12,493	25,000
Georgia	15,900	21,210	19,000	22,150	31,259
Idaho	4,080	2,700	2,588	5,928	10,909
Illinois	47,104	76,039	115,000	151,832	203,757
Indiana	46,826	61,712	56,500	81,208	116,121
Iowa	38,009	55,601	88,557	117,407	169,558
Kansas	9,917	27,000	39,889	59,485	89,223
Kentucky	3,500	8,256	6,376	14,820	24,725
Louisiana	6,067	6,898	2,500	4,000	13,594
Maine	16,835	8,540	12,000	16,865	21,027
Maryland	9,100	12,355	18,248	25,732	26,868
Massachusetts	42,000	52,193	64,717	76,168	105,488
Michigan	34,588	47,198	65,517	93,669	132,000
Minnesota	25,000	39,000	61,950	82,000	122,000
Mississippi	1,800	3,000	1,500	8,500	16,500
Missouri	20,579	32,088	45,147	64,460	83,742
Montana	3,329	3,759	3,181	11,000	19,580
Nebraska	28,791	42,451	55,989	60,000	80,959
Nevada	720	823	1,265	1,190	3,900
New Hampshire	5,000	6,023	8,266	10,422	14,837
New Jersey	42,632	36,666	50,002	58,179	75,420
New Mexico	1,989	1,500	2,416	3,695	6,226
New York	92,407	110,618	140,653	185,767	259,105
North Carolina	5,000	8,678	11,600	16,315	24,460
North Dakota	7,900	8,697	15,020	24,000	33,669
Ohio	56,000	74,625	105,000	152,950	208,705
Oklahoma	4,659	8,000	4,000	25,000	46,000
Oregon	8,872	11,929	14,629	20,419	26,110
Pennsylvania	52,257	66,488	109,174	128,062	189,082
Rhode Island	6,517	6,173	11,000	15,000	19,427
South Carolina	8,366	10,500	12,975	16,000	18,000
South Dakota	13,492	10,913	16,200	22,700	37,240
Tennessee	7,464	12,200	17,282	24,951	26,437
Texas	20,588	38,000	70,000	72,433	105,000
Utah	2,290	3,299	5,396	6,615	10,729
Vermont	3,632	4,655	6,548	9,489	12,272
Virginia	4,797	7,406	11,642	17,799	31,272
Washington	10,589	20,000	20,636	35,000	44,607
West Virginia	2,244	9,249	6,158	12,000	15,771
Wisconsin	21,965	29,750	45,000	70,490	99,000
Wyoming	2,328	4,478	2,034	3,262	5,900
Total	866,384	1,157,646	1,537,207	2,070,903	2,932,455

1916—A 100 M. P. H. Speed Era

All Records Broken—106.71 M. P. H. Reached—Three New Speedways—Resta Champion Driver

THE year 1916 will be recorded as a year of high speed contests on track and road. With the exception of the 300-mile race at Indianapolis, Decoration Day, when Resta's average was 83.99 m.p.h., as compared with 89.84 m.p.h., made by De Palma in 1915, all speedway records were broken. An average of 88.62 m.p.h. was recorded at all of the speedway races. In the fifteen championship award events an average speed of 92.45 m.p.h. was made. In ten of the speedway events this year, 100 m.p.h. or over was recorded. Whereas last year but seven drivers attained a speed of better than 100 m.p.h., 1916 saw twenty-one finishers with an average of better than 100 m.p.h. The fastest race of the year was the 20-mile Coney Island Cup Race, New York, on May 13, in which Aitken averaged 106.71 m.p.h. Aitken also has the honor of recording the long distance record of 105.95 m.p.h. for 100 miles, and 104.83 m.p.h. in the 250-mile Astor Cup Race, New York, Sept. 30. Both the Vanderbilt Cup and Grand Prize road races were featured by new records of 86.98 and 85.55 m.p.h., respectively.

498 Starters in 37 Events

This year there were 498 starters in the thirty-seven races with 238 finishers. Last year 333 cars started in twenty-two races and 137 finished. Out of twenty-seven races on speedways, and including the Vanderbilt and Grand Prize road events, Aitken finished first in seven, Resta in six, De Palma in four, Rickenbacher in three, Wilcox three, and Mulford, D'Alene and Cooper, one each. D'Alene and Cooper took second three times each, and Hughes, Milton, Lewis, Rickenbacher and Aitken each finished with two seconds to their credit. Lewis entered more races than any other driver, having participated in twenty-one events and placing in twelve. Rickenbacher entered nineteen races, took three firsts, two seconds, two thirds, one fourth and was unplaced in eleven. Resta enjoyed the distinction of winning every event in which he finished.

$243,781 in Prize Money

The distribution of prize money this year was lower than in 1915, a total of $243,781 being given in twenty-five of the main speedway events, and the two big road events, the Vanderbilt and Grand Prize. This compares with $282,000 in 1915. Of this total, Dario Resta, the champion driver of the year, received $44,400 in prize money, $5,000 of the Goodrich and $2,000 of the Bosch prize money and the $1,000 silver trophy of the latter. Aitken, who finished second in the championship award, received $30,206 in prize money. Rickenbacher was third with $20,050, while De Palma won $15,454 and D'Alene, $15,394. These five were the only drivers to win in excess of $10,000. By winning fourteen firsts the Peugeot won first honors for the year. Three new speedways were opened in 1916 at Kansas City, Cincinnati, and Uniontown. The latter is a 1⅛-mile board track. The Kansas City speedway is a 1¼-mile dirt track. Cincinnati opened a 2-mile board oval; and Uniontown, Pa., a 1⅛-mile board track.

Records in 1916 Speedway and Road Races

Barney Oldfield, driving the Christie, broke the speedway record in the Ventura trophy race on the Ascot speedway March 19, turning a lap in 45 sec. flat.

Bob Burman, driving a Peugeot, from a standing start, made a lap in 58 1/5 sec., which made a new record. This was also at the Ascot speedway, March 19.

John Aitken, driving a Peugeot, established a new world's record in the 20-mile event at Sheepshead Bay, May 13. His time was 11:15, or at an average speed of 106.71 m.p.h., lowering the record made by Resta on the same track in 1915, namely, 11:40.92.

R. R. Duff set amateur's speedway lap record of 94 m.p.h. on Chicago speedway, May 21.

Barney Oldfield, driving his Christie, circled the Chicago speedway in 1 min. 3⅘ sec., or at 113 m.p.h.

Dario Resta set new record for Chicago speedway, June 11, his time being 3 hr. 2 min. 31.64 sec. for the 300-mile event, or at a speed of 98.61 m.p.h. Resta also broke the record made by Porporato last year for 100 miles, which was 1 hr. 28 sec., his time being 59 min. 34.7 sec. Resta bettered his time or 2 hr. 2 min. 17 sec. for 200 miles last year by a second.

June 10 Ralph De Palma established a new American record for distance covered in 1 hr., driving on a speedway track, when in the 60 min. he covered 93.72 miles. The record was made on the Chicago speedway between qualifying trials for the annual derby.

In a dual meet with Ralph De Palma at the Chicago speedway, June 18, Dario Resta established new American records for 10, 24 and 50 miles. His mark of 96 m.p.h. for the 50-mile broke the record of 88.87 m.p.h. set by Christiaens in 1914. The new records for the 10-mile and 24-mile are 102.5 and 105.1 m.p.h, respectively.

Harry Hurtz, driving a Houk Special, broke the mile record for cars under 231 cu. in. when he turned the mile oval at Ascot in 54 sec., June 27.

Harold Brinker, driving a Cadillac eight, July 4 lowered former record for 132-mile road race from Denver to Laramie, Wyo., by 33 min., his time being 2 hr. 55 min. 10 sec.

Dario Resta set record of 1 hr. 30 min. 42 sec. for 150 miles on 1¼-mile tracks at Omaha, July 15.

Eddie Rickenbacher, driving the Maxwell, broke the world's 25-mile record at Omaha, July 9, his time being 1[illegible]:36.47, against 17:30.4, made by Oldfield at Indianapolis in 1914.

Dario Resta, driving the Peugeot, broke the world's 5-mile record at Omaha, July 9, his time being 2:44.52, against 3:11.75, made by Bragg at Los Angeles in 1912.

W. Rader, driving a Packard racing test car, fitted with a twelve-cylinder aviation engine, broke previous track record at Indianapolis, Aug. 2, turning the 2½-mile oval in 1:29:32, an average speed of 100 m.p.h.

Aitken broke world's 250-mile record at Sheepshead Bay, Sept. 30, driving a Peugeot at an average speed of 104.83 m.p.h. The previous record was made by Resta on the Chicago speedway, namely, 2:33:31/16.

In October Ralph De Palma was granted an official 50-mile speedway record for his performance on the Omaha 1¼-mile track, his time being 29:02.47, or at a speed of 103.45 m.p.h. The previous record was held by Resta with a time of 31:57.40.

Aitken broke 100-mile record at Sheepshead Bay, Oct. 28, driving a Peugeot at an average speed of 105.95 m.p.h.

A new record for the grand prize race was set at Santa Monica, Nov. 18, when a Peugeot, piloted twenty laps of the 8.04-mile course by Howard Wilcox and the remaining twenty-eight by Aitken, won the race in 4:42:47, or at an average speed of 85.59 m.p.h., lowering the former record of 77.20 m.p.h. made by Pullen in 1914.

A. H. Patterson, driving a Hudson super-six, set a new world's record for non-stop road race of 403 miles at an average of 78.13 m.p.h. at Santa Monica, Nov. 18.

In the Vanderbilt Cup race at Santa Monica, Nov. 16, Dario Resta established an average of 86.9897 m.p.h. for 294.0355 miles, or thirty-five laps of the 8.041-mile circuit, a new record for both the Vanderbilt and the Santa Monica course over which Tetzlaff in 1912 averaged 78.72 m.p.h. for 302 miles.

Factory Additions Total 9,362,881 Square Feet in 1916

Partial Returns Show Large Expansion in All Branches of Manufacture—Additions and New Equipment Cost $17,682,255

PARTIAL, though fairly complete, returns in a census conducted by THE AUTOMOBILE throughout all branches of the automobile, motor truck, accessory and allied industries show that during the year 1916 nearly 10,000,000 sq. ft. were added to factories at a cost of approximately $10,000,000, while new machine equipment, etc., added during the year amounted to over $8,000,000. Although complete cost figures are not available, the total outlay for enlarged and improved manufacturing facilities, as indicated by the census returns, represents a total of over $20,000,000, the exact amount of expenditures given being $17,682,265.

Last year the extent of floorspace added was slightly larger according to the partial returns made in the census conducted at that time, giving a total of 11,142,508 sq. ft. for the 12 months of 1915. However, the expenditures for these additions last year total only $8,251,755, or over $1,000,000 less than was expended by manufacturers during 1916 for additional floorspace. Moreover, the expenditure for new equipment last year was only $4,770,590, only a little more than half of the outlay during 1916 when $8,233,190 was devoted to this purpose. As indicated by last year's returns the total cost of increased factory facilities was $12,886,342, as compared with $17,682,255.

These figures are so tremendous in themselves that they do not convey a full understanding of the enormous expansion which has characterized the industry during the past 12 months. To bring this out a little more strongly a few graphic illustrations may be of value. For example, if the entire extent of the floorspace added to automobile, truck and accessory factories this year were to be contained in a single one-story building 100 ft. wide, this would be nearly 18 miles in length. To give an idea of the magnitude of the sums expended for increased factory facilities this year, if the $9,449,065, which went for factory additions, were converted into silver dollars and piled one on top of another, the column would reach over 18 miles in height. As for the $8,233,190 in added equipment, if this were treated in the same manner it would attain a height of 16 miles, so that the total expenditure, if it could be imagined in such a form, would represent a column 34 miles high. If paper dollars were used and placed end to end, the $17,682,255 would form a band about 2040 miles in length, or over twice the distance from New York to Chicago and two-thirds of the distance across the United States from coast to coast.

Many Large Additions

Taking up the additions made by the automobile manufacturers, 3,775,776 sq. ft. were added by forty-one companies at a cost of $2,312,000, and equipment representing an outlay of $1,321,023 brought the total expenditure up to $3,633,023. Willys-Overland added half a million square feet, as did Apperson; Hudson added 484,392; Haynes 350,000; Velie 200,000, and Reo 176,294. Unfortunately cost statistics for a number of the largest additions are not available so that the total is far lower than it should be. Similarly in numerous other cases the cost of the additions is given, but the number of square feet of floorspace added is not furnished, so that it can be easily seen that this total is also below its actual value. Of the expenditures cited in the table herewith the $386,000 spent by Premier on new equipment for its large factory is of interest. Apperson's new factory group cost $300,000 and Briscoe's addition $250,000, with another $200,000 expended for equipment. Haynes spent a round half million, equally divided between factory additions and new equipment; and White paid $200,000 for enlarged manufacturing room.

Truck Makers Expand Plants

In the commercial vehicle field large additions have been made in many factories which failed to send in returns, but the total of 278,017 sq. ft. added by some twenty concerns is a fair indication of the marked expansion taking place throughout the entire industry. These additions were made at an expense of considerably more than the $150,000 given in the returns, as will be noted by referring to the numerous blank spaces in this column of the tabulation. In the way of added equipment the returns were a little more complete, making a total of $272,500, the largest item of which is the $75,000 spent by the H. J. Koehler Motors Corp. The largest increase of factory space in this division, according to the returns, has been made by the Gramm-Bernstein Motor Truck Co., which is credited with the addition of 75,000 sq. ft. constructed at a cost of $27,000. This company also expended $70,000 for new equipment, making the total expenditure for the purpose of increasing and facilitating production $97,000. Other truck manufacturers who have made notable additions to their factory and equipment during the year are: Kleiber & Co., Inc., 46,000 sq. ft., costing $75,000; Cadillac Auto Truck Co., 33,792 sq. ft., and Republic Motor Truck Co., 30,000 sq. ft.

Tractor and trailer companies have increased their facilities as might be expected from the development of their respective fields during 1916. Reports from only three tractor manufacturers show 28,000 sq. ft. added at a cost of $251,000, an expenditure of $108,500 bringing the total for these three concerns alone to $359,500.

Engine Builders Increase Facilities

Nine engine manufacturers report 406,740 sq. ft. of additional floorspace during the past 12 months, partial returns showing the additions of only five concerns cost $247,000 and the new equipment increased this expenditure by eight concerns to $1,033,000, the equipment installed by these companies during the year amounting to $786,000.

Axle makers added 74,600 sq. ft. and $166,000 of new equipment and the carbureter manufacturers, although recording only 18,600 sq. ft. of additional floorspace, spent $106,000 for new machinery, etc. Bearing makers added 81,200 sq. ft., this including reports from only two companies, the U. S. Ball Bearing Mfg. Co. spending $160,000 for 80,000 sq. ft. Four bearing makers added $321,000 worth of new equipment.

In the body field three companies added over 100,000 sq. ft., the Auto Body Co., Dayton Body Co. and W. S. Seaman Co. In this division 494,588 sq. ft. of floorspace was added by thirteen companies, total expenditures for buildings and equipment being $570,800.

The largest addition reported by wheel manufacturing

concerns is that of W. K. Prudden & Co., which spent $250,000 in securing 185,000 sq. ft. Ten companies added 319,230 sq. ft. and $289,000 worth of new machinery at a total expenditure of $695,700.

Tire makers added nearly a million sq. ft. during the year, the total for nineteen companies being 914,400 sq. ft., costing $2,195,000, the $621,100 worth of additional machinery bringing the total spent to $2,816,100.

Parts makers added nearly as much space as the tire manufacturers, the total for thirty-five companies being 767,165 sq. ft. costing $930,000, while they spent twice as much for new equipment as reported by the tire factories, the $1,305,000 expended for this making the total expenditure by parts makers $2,235,000.

The accessory field naturally reports the largest increases in all respects, adding 2,201,565 sq. ft., the cost figures given totaling $2,350,865, and the $2,722,767 spent for added equipment makes the total outlay for expansion as reported by 134 concerns in this branch of the industry $5,073,632. Some of the largest items which might be mentioned are the 375,000 sq. ft. added by Stewart-Warner and costing with equipment $885,000; 180,500 sq. ft. added by Prest-OLite; 130,000 by Bosch and 120,650 added by the American Auto Trimming Company.

A Summary of the Principal Factory Additions

Cost of New Facilities, Including Additional Equipment Required by the Industry in 1916

AUTOMOBILES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Alter Motor Car Co.	51,600	$45,000	....	$45,000
Apperson Bros.	500,000	300,000	....	300,000
Auburn Automobile Co.	45,000	18,000	....	18,000
Autocar Co.	85,000	....	....	....
Babcock Co., H. H.	87,126	....	....	....
Baker R. & L. Co.	1,000	3,500	$35,723	39,223
Bartholomew Co.	....	....	40,000	40,000
Bimel Automobile Co.	500	500	250	750
Briscoe Motor Corp.	....	250,000	200,000	450,000
Chalmers Motor Co.	156,000	....	....	....
Crow-Elkhart Motor Co.	75,100	80,000	27,000	107,000
Dodge Bros.	....	340,000	....	340,000
Dort Motor Car Co.	....	60,000	....	60,000
Fargo Motor Car Co.	....	....	350	350
Franklin Mfg. Co., H. H.	143,000	....	....	....
Halladay Co., L. P.	....	....	12,000	12,000
Haynes Automobile Co.	350,000	250,000	250,000	500,000
Hudson Motor Car Co.	484,392	....	....	....
Jordan Motor Car Co.	30,000	....	20,000	20,000
Kent Motors Corp.	....	....	50,000	50,000
King Motor Car Co.	....	20,000	10,000	30,000
Kissel Motor Car Co.	....	100,000	75,000	175,000
Kline Car Corp.	....	....	2,000	2,000
Lexington-Howard Co.	30,000	50,000	3,500	53,500
Madison Motors Co.	175,000	....	....	....
Moore Motor Co.	6,000	....	....	....
National Motor Car & Veh. Corp.	68,400	125,000	50,000	175,000
Oakland Motor Car Co. of Mich.	132,300	150,000	...	150,000
Ogren Motor Wks.	45,000	120,000	5,000	125,000
Packard Motor Car Co.	90,000	....	....	....
Pilot Motor Car Co.	50,000	10,000	2,000	12,000
Premier Motor Corp. of N. Y.	....	....	386,000	386,000
Reo Motor Truck Co.	176,294	....	....	....
Saxon Motor Car Corp.	150,000	10,000	5,000	15,000
Singer Motor Co., Inc.	2,500	....	2,200	2,200
Stanley Motor Carriage Co.	....	....	10,000	10,000
Stutz Motor Car Co.	65,300	100,000	50,000	150,000
Velie Motors Corp.	200,000	80,000	75,000	155,000
White Co.	73,264	200,000	....	200,000
Willys-Overland Co.	500,000	....	....	....
Woods Motor Vehicle Co.	....	....	10,000	10,000
Total	**3,775,776**	**$2,312,000**	**$1,321,023**	**$3,633,023**

COMMERCIAL VEHICLES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Available Truck Co.	3,000	$2,000	$500	$2,500
Beck Automobile Wks.	....	....	2,000	2,000
Bessemer Motor Truck	....	....	2,000	2,000
Burford Motor Truck Co.	12,000	....	7,500	7,500
Cadillac Auto Truck Co.	33,792	....	....	....
Denby Motor Truck Co.	....	....	50,000	50,000
Diamond T Motor Car Co.	20,000	....	....	....
Four Wheel Drive Auto Co.	27,000	....	15,000	15,000
Gary Motor Truck Co.	....	....	1,000	1,000
General Motor Truck Co.	....	....	25,000	25,000
Gramm-Bernstein Motor Truck Co.	75,000	27,000	70,000	97,000
Indiana Truck Co.	....	....	6,000	6,000
Kleiber & Co., Inc.	46,000	75,000	5,000	80,000
Koehler Motors Corp., H. J.	....	....	75,000	75,000
Larrabee-Deyo Motor Truck Co.	7,100	6,000	4,000	10,000
Lewis Hall Iron Wks.	1,000	....	....	....
Moreland Motor Truck Co.	....	....	5,500	5,500
Republic Motor Truck Co.	30,000	....	....	....
Rowe Motor Mfg. Co.	10,000	....	2,000	2,000
Zeitler & Lamson Truck Co.	13,125	40,000	2,000	42,000
Total	**278,017**	**$150,000**	**$272,500**	**$422,500**

TRACTORS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Ford Tractor Co., Inc.	18,000	....	$5,000	$5,000
Brillon Iron Works	....	$1,000	3,500	4,500
Sweeney Tractor Co.	10,000	250,000	100,000	350,000
Total	**28,000**	**$251,000**	**$108,500**	**$359,500**

TRAILERS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Detroit Trailer Co., Inc.	....	....	$3,000	$3,000
Michigan Auto Trailer Co.	3,000	....	1,500	1,500
Warner Mfg. Co.	....	....	5,000	5,000
Total	**3,000**	....	**$9,500**	**$9,500**

ENGINES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Buda Co	50,000	$105,000	$175,000	$280,000
Continental Motors Co.	30,000	....	....	....
Davis Mfg. Co.	35,000	60,000	80,000	140,000
Duesenberg Motor Co.	10,000	....	14,000	14,000
Lycoming Foundry & Mach. Co.	39,000	60,000	70,000	130,000
Rutenber Motor Co.	....	10,000	300,000	310,000
Teetor-Hartley Motor Co.	5,640	12,000	10,000	32,000
Van Blerck Motor Co.	1,100	....	97,000	97,000
Weidely Motors Co.	233,000	....	40,000	40,000
Total	**406,740**	**$247,000**	**$786,000**	**$1,033,000**

AXLES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Empire Axle Co.	54,600	....	$25,000	$25,000
Torbensen Axle Co.	15,000	....	110,000	110,000
Walker Weiss Axle Co.	5,000	$10,000	25,000	35,000
Zeigler Mfg. Co.	....	....	6,000	6,000
Total	**74,600**	**$10,000**	**$166,000**	**$176,000**

CARBURETERS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Breeze Carbureter Co.	10,000	$18,000	$13,500	$31,500
Flechter & Co., L. V.	....	....	2,500	2,500
H & N Carbureter Co.	5,000	....	20,000	20,000
Master Carbureter Corp.	....	....	10,000	10,000
Shakespeare Co.	3,600	....	15,000	15,000
Stromberg Motor Devices Co.	....	....	25,000	25,000
Zenith Carbureter Co.	....	40,000	20,000	60,000
Total	**18,600**	**$58,000**	**$106,000**	**$164,000**

BEARINGS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Ahlberg Bearing Co.	1,200	....	$5,000	$5,000
Lumen Bearing Co	....	$12,500	41,000	53,500
Schafer Ball Bearing Co., Inc.	....	....	75,000	75,000
U. S. Ball Bearing Mfg. Co.	80,000	160,000	200,000	360,000
Total	**81,200**	**$172,500**	**$321,000**	**$493,500**

BODIES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Auto Body Co.	174,340	$200,000	$50,000	$250,000
Collins V. W. Co., R. N.	20,000	35,000	35,000	70,000
Dayton Body Co.	107,000	40,000	300	40,300
Fleetwood Metal Body Co.	63,000	60,000	5,000	65,000
Fry Brothers Mfg. Co.	4,000	....	800	800
Griswold Motor & Body Co.	....	....	4,000	4,000
Hayes-Ionia Co.	15,800	6,000	36,000	42,000
Metropolitan Auto & Crg. Co.	....	....	50,000	50,000
Monroe Body Co.	1,548	....	....	....
Motor Truck Body Co.	4,000	20,000	2,000	22,000
New Haven Carriage Co.	5,000	5,000	6,000	11,000
W. Pfeiffer Auto & Crg. Wks.	....	....	700	700
Seaman Co., W. S.	100,000	....	15,000	15,000
Total	**494,588**	**$366,000**	**$204,800**	**$570,800**

WHEELS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Baltimore Hub Wheel & Mfg. Co.	....	....	$2,000	$2,000
Bimel Spoke & Auto Wheel Co.	....	$16,000	17,000	33,000
Craftsman Motor Corp.	24,000	....	70,000	70,000
Hayes Motor Truck Wheel Co.	1,500	700	20,000	20,700
Great Western Mfg. Co.	20,000	10,000	10,000	20,000
National Wire Wheel Wks., Inc.	....	....	45,000	45,000
Sewell Cushion Wheel Co.	33,730	100,000	15,000	115,000
Spranger Wire Wheel Co.	30,000	....	25,000	25,000
Mutual Wheel Co.	25,000	30,000	25,000	55,000
Prudden & Co., W. K.	185,000	250,000	60,000	310,000
Total	**319,230**	**$406,700**	**$289,000**	**$695,700**

A Summary of the Principal Factory Additions

TIRES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Ajax Rubber Co., Inc	100,000	$350,000	$200,000	$550,000
American Auto Tire Co., Inc.	....	90,000	....	90,000
Brunswick Balke-Collender Co.	40,000	....	....	....
Colorado Tire & Leather Co.	....	18,000	50,000	68,000
Firestone Tire & Rubber Co.	....	105,000	....	105,000
Falls Rubber Co.	450,000	....	30,000	30,000
Goodrich Co., B. F.	....	500,000	....	500,000
Goodyear Tire & Rubber Co.	....	750,000	....	750,000
International India Rubber Corp.	30,000	25,000	....	25,000
International Rubber Co.	....	14,000	37,100	51,100
Keystone Tire Co., Inc.	34,200	....	....	....
Leather Tire Goods Co.	....	....	1,000	1,000
McCreary Tire & Rubber Co.	....	1,000	....	1,000
Mohawk Rubber Co.	28,000	100,000	150,000	250,000
Michelin Tire Co.	150,000	....	....	....
Morgan & Wright Co.	45,000	....	....	....
National Rubber Filler Co.	7,200	12,000	3,000	15,000
Republic Rubber Co.	....	200,000	....	200,000
Star Rubber Co.	30,000	30,000	150,000	180,000
Total	914,400	$2,195,000	$621,100	$2,816,100

PARTS

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
American Brass Fdry. Co.	50,000	....	$1,500	$1,500
American Brass & Iron Co.	....	....	1,000	1,000
Armstrong Rubber Co., Inc.	....	....	5,000	5,000
Bunting Brass & Bronze Co.	6,000	$8,000	10,000	18,000
C. A. S. Products Co.	....	....	10,000	10,000
Champion Mach. & Forging Co.	20,000	35,000	75,000	110,000
C. Cowles Co.	....	....	6,000	6,000
Cotta Transmission Co.	27,000	....	....	....
Crum Wiley Mfg. Co.	....	....	1,000	1,000
Dunn Products Co.	30,000	....	25,000	25,000
Detroit Forging Co.	50,000	50,000	25,000	75,000
Doehler Die Casting Co.	90,000	150,000	30,000	180,000
Eccles Co., Richard	....	1,000	1,800	2,800
Ford-Clark Co.	....	....	15,000	15,000
Frost Gear & Forge Co.	6,000	10,000	55,000	65,000
Fuller & Sons Mfg. Co.	25,000	50,000	75,000	125,000
Ganschor Co., Wm.	8,500	....	40,000	40,000
Hoosier Auto Parts Co.	....	....	26,000	26,000
Indianapolis Brass Co.	....	....	2,500	2,500
Metal Auto Parts Co.	40,000	....	20,000	20,000
Murray Mfg. Co.	100,000	155,000	50,000	205,000
M & L Corp	20,000	....	200,000	200,000
National Bronze & Alum. Fdry. Co	20,000	25,000	12,000	37,000
New Process Gear Corp.	120,000	350,000	400,000	750,000
Oakes Co.	20,000	....	50,000	50,000
Ohio Forge Co.	....	....	25,000	25,000
Peru Auto Parts Mfg. Co.	5,000	3,000	5,000	8,000
Pneumatic Spring Co.	4,500	....	....	....
Puritan Machine Co.	15,000	20,000	5,000	25,000
S. A. Machine Co.	9,000	8,000	12,000	20,000
Thiery & Kendrick Mfg. Co.	....	....	6,000	6,000
Torbensen Gear & Axle Co.	50,000	....	....	....
Universal Car Equipment Co.	....	....	5,200	5,200
Warner Gear Co.	40,000	50,000	100,000	150,000
Wisconsin Aluminum Fdry. Co.	11,165	15,000	10,000	25,000
Total	767,165	$930,000	$1,305,000	$2,235,000

ACCESSORIES

Company	Space Added Sq. Ft.	Cost of Additions	Added Equipment	Total Cost
Adams Truck Fdry. & Mach. Co.	....	....	$50,000	$50,000
American Auto Trimming Co.	120,650	....	....	....
American Lava Co.	7,500	....	....	....
American Soap & Washoline Co.	....	....	4,500	4,500
Anchor Corrugating Construction Co.	1,500	$3,500	1,500	5,000
"Angier's"	....	....	8,000	8,000
Atlas Welding Wks.	....	....	500	500
Auburn Ignition Mfg. Co.	300	....	....	....
Automobile Crank Shaft Corp.	19,800	50,000	100,000	150,000
Badger Brass Mfg. Co.	....	....	10,000	10,000
Benford Mfg. Co.	14,000	18,000	28,000	46,000
Bernz, Otto	5,000	2,000	500	2,500
Bosch Magneto Co.	130,006	....	....	....
Butler Mfg. Co.	....	....	5,000	5,000
Carr Fastener Co.	7,500	20,000	75,000	95,000
C & E Mfg. Co., Inc.	2,200	8,500	2,000	10,500
Champion Ignition Co.	23,000	75,000	59,000	134,000
Champion Spark Plug Co.	55,000	....	....	....
Chicago Metal Mfg. Co.	4,000	....	2,000	2,000
Cincinnati Ball Crank Co.	22,500	40,515	65,231	105,746
Cincinnati Elec. Co	5,000	....	6,000	6,000
Cincinnati Screw Co.	12,800	....	100,000	100,000
Cleveland Battery & Elec. Co.	20,000	....	17,000	17,000
Columbia Smelting & Ref. Wks.	14,000	....	76,000	76,000
Columbian Brass Fdry.	400	....	6,000	6,000
Commercial Machine Co.	1,000	....	7,000	7,000
Cortland Carriage Goods Co.	60,000	125,000	60,000	185,000
Crabill Hose Clamp Co	....	....	1,000	1,000
Detroit Battery Co.	25,000	....	....	....
Detroit Stamping Co.	....	....	2,500	2,500
Diamond Chain & Mfg. Co.	10,000	10,000	25,000	35,000
Ditwiler Mfg. Co.	....	....	4,000	4,000
Dunkirk Corp	....	....	1,500	1,500
Edmunds & Jones Corp.	35,000	50,000	25,000	75,000
Esco Mfg. Co.	....	....	1,500	1,500
Essex Storage Battery & Supply Co.	4,000	....	4,000	4,000
Fisher Mfg. Co.	7,000	....	10,000	10,000
Fostoria Screw Co.	15,000	....	25,000	25,000
Fyr-Fyter Co.	....	....	7,500	7,500
Geisel's Perfection Endless Web Belt	14,800	....	500	500
Gem Stamped Steel Co.	4,800	....	....	....
Gemco Mfg. Co.	15,000	....	....	....
General Aluminum & Brass Mfg. Co.	15,000	20,000	62,000	82,000
Globe Machine & Stamping Co.	16,000	20,000	15,000	35,000
Globe Shirt & Overall Co.	7,200	12,000	3,500	15,500
Glover Equipment Co.	6,000	3,000	1,000	4,000
Golde Patent Mfg. Co.	10,000	....	....	....
Grier Pressed Steel Co.	....	....	250,000	250,000
Grinden Art Metal Co.	....	....	10,000	10,000
Grossman Mfg. Corp., Emil	15,000	....	....	....
Grus Leaf Spring Oiler Co.	3,000	5,000	5,000	10,000
Hall Lamp Co., C. M.	15,000	....	....	....
Harcla Research Co.	....	....	250	250
Henning & Sons, V.	6,000	8,000	....	8,000
Hill Insulating & Mfg. Corp.	4,500	....	18,000	18,000
H G Chemical Products Co.	38,000	....	....	....
Holihan Mfg. Co.	25,000	80,000	15,000	95,000
Hollands Mfg. Co.	1,300	1,000	5,000	6,000
Horst Co., J.	....	....	5,000	5,000
Houpert Machine Co.	10,800	....	60,000	60,000
Imperial Brass Mfg. Co.	....	....	30,000	30,000
Interstate Electric Co.	24,000	....	....	....
Inter-State Machine Products Co.	....	....	3,600	3,600
Isaacson Co., L. G.	5,300	5,500	....	5,500
Alexander Mfg. Co., J.	5,000	....	10,000	10,000
Catherman Mfg. Concern, J. A.	8,000	....	....	....
Kellogg Mfg. Co.	15,000	28,000	25,000	53,000
Kinsler Bennett Co.	3,000	....	30,000	30,000
Kilborn-Sauer Co.	10,000	....	2,500	2,500
Kokomo Electric Co.	7,500	10,000	15,000	25,000
Koven & Bro., L. O.	5,000	....	....	....
Levy Motors Co., James	16,000	....	1,200	1,200
Limousine Top Co.	54,000	....	4,000	4,000
London Auto Supply Co.	10,000	....	2,000	2,000
McRae & Roberts	....	....	5,000	5,000
Michigan Hearse & Mtr. Co.	20,000	15,000	1,500	16,500
Michigan Motor Specialties Co.	....	....	15,000	15,000
Modern Elec. & Mach. Co.	3,825	12,000	12,000	24,000
Morse Chain Co.	40,000	40,000	39,000	79,000
Moto-Meter Co., Inc.	16,000	....	10,000	10,000
Muskegon Motor Specialties Co.	13,000	10,000	100,000	110,000
Mutual Electric & Mach. Co.	....	....	25,000	25,000
National Can Co.	20,000	....	....	....
National Elec. Welder Co.	19,000	....	20,000	20,000
National Mfg. Co.	1,000	....	4,000	4,000
National Motor Supply Co.	50,000	....	6,000	6,000
Newark Stamping & Fdry. Co.	10,000	5,000	2,000	7,000
Nilson-Miller Co.	1,750	5,000	....	5,000
Northwestern Chemical Co.	13,000	25,000	3,000	28,000
Ohio Metal Products Co.	10,800	25,000	25,000	50,000
Perkins-Campbell Co	15,000	10,000	....	10,000
Pittsfield Spark Coil Co.	....	....	1,000	1,000
Piston Ring Co.	6,000	75,000	40,000	115,000
Prest-O-Lite Co.	180,500	375,000	75,000	450,000
Pullan Steel Spring Co.	....	....	3,000	3,000
Reade Mfg. Co.	....	....	5,000	5,000
Remy Electric Co.	36,000	90,000	70,000	160,000
Rens Bros. Co.	1,600	4,500	11,000	15,500
Reilly Co., John	....	....	10,000	10,000
Reliance Co.	....	....	7,500	7,500
Retlaw Mfg. Co.	10,000	25,000	7,500	32,500
Rock Island Mfg. Co.	10,000	8,000	20,000	28,000
Romort Mfg. Co	....	10,000	5,000	15,000
Saginaw Steel Metal Wks.	....	....	5,000	5,000
Scherer & Co., H	60,000	75,000	....	75,000
Sevison Electric Co.	....	....	26,000	26,000
Schilling Co., S. F.	1,250	....	3,000	3,000
Sloan & Chase Mfg. Co., Ltd	14,000	4,750	18,500	23,250
Stewart-Warner Speedometer Corp.	375,000	600,000	285,000	885,000
Splitdorf Elec. Co.	110,000	....	....	....
Spiro Mfg. Co., C.	....	....	12,000	12,000
Steel Products Co.	....	200,000	190,000	390,000
Swan Mfg. Co.	6,000	15,000	11,000	26,000
Syracuse & Elbridge Glove & Mitten Co.	....	....	500	500
Tegufilm Chemical Mfg. Co., Inc.	1,000	....	....	....
Triple Action Spring Co.	9,150	30,000	800	30,800
Troy Carriage Sun Shade Co.	....	....	10,000	10,000
Trump Mfg. Co.	1,580	8,000	10,000	18,000
Tutten Machine & Vise Co.	....	....	35,000	35,000
U. S. Light & Heat Corp.	....	....	72,839	72,839
United States Welding Co.	3,000	500	500	1,000
Universal Machine Co.	3,000	....	40,000	40,000
Universal Motor Prod. Co.	....	....	10,000	10,000
Van Cleef Bros.	5,000	....	....	....
Veeder Mfg. Co.	....	....	2,000	2,000
Wainwright Eng. Corp	14,000	10,000	15,000	25,000
Weaver Mfg. Co.	11,000	....	....	....
Wells Mfg. Co., R. C.	....	....	3,750	3,750
Webster & Perks Tool Co.	....	....	35,000	35,000
Weiss, Louis T	....	....	1,000	1,000
Williams Mfg. Co	2,500	1,100	210	1,310
Wilson & Co.	47,260	60,000	28,000	88,000
Woodison Co.	60,000	....	2,000	2,000
"X" Laboratories	8,000	17,000	19,387	36,387
Total	2,201,565	$2,350,865	$2,722,767	$5,073,632
GRAND TOTAL	9,362,881	$0,449,065	$8,233,190	$17,682,255

Automobile Chronology for 1916

Important Developments in the Industrial and Financial Fields Arranged According to Date of Occurrence

JANUARY

1—Kentucky Wagon Co., Louisville, to assemble cars for the Dixie Motor Car Co.

1—Pfau Mfg. Co., Cincinnati enters automobile field with output of brass specialties.

1—American Rotary Valve Co., Anderson, Ind., discontinues the manufacture of electric motors.

2—Avery Farm Implement Co., Peoria, Ill., to make $295 tractor.

3—Auto Parts Mfg. Co., Milwaukee, reorganizes and absorbs Badger Specialties Mfg. Co.

3—With more than 22,000 miles to its credit, the Maxwell car, in non-stop run started Nov. 22, was stopped Jan. 3 after 44¼ days' test. Road records are: 5000 miles in 10 days; 10,000 miles in 20 days; 12,405 miles in 25 days; and 20,000 miles in 30 days.

4—U. S. district court judge signs final decree in Austin-Cadillac two-speed axle case, decision on which was rendered a year ago, granting Austin an injunction and damages against Cadillac.

4—Kelly-Springfield Tire raises 7½ to 26 per cent.

4—Overland reduces price of larger four $55, from $750 to $695.

10—National Automobile Chamber of Commerce cross-licensing agreement in force and includes agreement on exchange of shop right on patents and members.

10—National Acme Mfg. Co., Cleveland, acquires the business and plant of the Windsor Machine Co., Windsor, Vt.

12—Empire, Falls, Globe and Pennsylvania tire companies increase prices 10 to 25 per cent.

14—McClurg Rubber Co., Coshocton, Ohio, takes over S. & M. Tire & Rubber Co.

14—Lion Tire & Rubber Co., Lafayette, Ind., formed with a capital of $150,000, to manufacture tires. Purchases Heinze plant in Lafayette.

15—Fritchle Automobile & Battery Co., Denver, brings out a gas-electric car, with one electric unit and a four-cylinder motor.

15—Entz patents controlled by six members representing General Electric and Owen Magnetic companies.

17—Moline Plow Co., Freeport, Ill., to manufacture the Stephens six-cylinder automobile.

17—Randall-Faichney Co., Boston, reorganized. Management takes over assets of old one.

18—Gasoline 22 cents wholesale in New York City.

24—Stutz Motor Car Co., Indianapolis, doubles plant.

24—Vesta Accumulator Co., Chicago, brings out electric transmission.

26—Gasoline selling at 29 cents in New York.

29—Chevrolet-General Motors syndicate offers for exchange five shares of Chevrolet stock for one of General Motors. Voting trust formed.

29—Stock offer of Chevrolet-G. M. Syndicate changed to four shares of Chevrolet for one General Motors.

30—12,000 carloads of automobiles shipped in January.

30—Woods Motor Vehicle Co., Chicago, to build a gas-electric car at $2,700

31—Ford produced 44,365 cars in January, second largest month. In April, 1915, produced 46,510.

FEBRUARY

7—Carter Carbureter Co., St. Louis, forms sales department. Cancels selling arrangements with H. W. Johns-Manville Co., to market its products direct.

11—Chalmers Motor Co., Detroit, arranges with Agricultural Credit Co., Chicago, for time payment service for dealers.

11—Studebaker arranges through Commercial Investment Trust, New York, for time payments.

14—General Electric Co. raises prices of Genemotor $10 to $85. Takes out license to manufacture under Coleman starter patents, Nos. 746,157 and 842,827.

15—U. S. circuit court of appeals confirms decision of district court judge, who declared the Perlman demountable rim patent valid and infringed by the Standard Welding Co.

17—Value of automobile output increases 350.3 per cent between 1909 and 1914. Government statistics show value of output in 1914 was 181.7 per cent greater than 5 years before.

17—Toledo, second largest automobile city. Cars numbering 95,650 left its factories in 1915. One thousand electric systems and 25,000 spark plugs per day produced there.

18—Briscoe Motor Co., Jackson, to absorb Jackson Motor Shaft Co., in July.

21—Buick prices advanced $35. Roadster at $985 and touring car at $1,020.

21—Bimel Buggy Co., Sidney, Ohio, reincorporates as Bimel Automobile Co.

24—Thomas B. Jeffery Co. increases wages 10 per cent and reduces working hours to 50 a week for day and 55 for night work.

29—Kardo Axle suit reopened. Ohio court of appeals upholds company's validity and orders rehearing.

MARCH

2—Champion Spark Plug Co., Toledo, increases output to 100,000 spark plugs daily. Former production 45,000 daily.

2—Sparks-Withington Co., maker of Sparton horns, wins patent battle through reversal of a United States district court decision issued in suit of Lovell-McConnell Mfg. Co., maker of Klaxon horns, against Oriental Rubber Supply Co., dealer in Sparton horns. No infringement on patent of Klaxon company was admitted, as patent was declared invalid.

2—Federal court of appeals reverses decision that dismissed axle patent infringement suit brought by the Kardo Co. against H. J. Adams.

3—New York gasoline reaches 24 cents a gallon, wholesale. Owners paying from 26 to 31 cents a gallon. Were paying from 14 to 17 cents year ago.

4—Studebaker Corp. raises prices of five models. In four-cylinder class, three-passenger roadster, $825 to $850; seven-passenger touring car, $845 to $875; landau-roadster, $1,145 to $1,150. Of six-cylinder models, three-passenger touring car, $1,025 to $1,060, and seven-passenger touring car, $1,050 to $1,085.

4—Pierce-Arrow Motor Car Co. plant in Buffalo closed, owing to strike of machinists. Six thousand men out.

6—Mallbohm roadster at $595 is product of Mallbohm Motors Co., Racine, Wis.

6—Automobiles, trucks and parts rank fifth in exports. Gained 232 per cent in 1915, to $121,180,139. Iron and steel first, with $338,703,720.

7—Locomobile Co. of America changes truck name to Riker.

8—Injunction against Standard Welding Co., Cleveland, prohibiting manufacture and sale of demountable rims, held to infringe Perlman patent No. 1,052,270, filed June 29, 1906.

8—Arbenz Car Co., Chillicothe, Ohio, taken over by National United Service Co., New York.

8—Resulting from suit of Louis H. Perlman against Standard Welding Co., charging infringement of Perlman's basic patent on demountable rim, injunction is issued against Standard Welding Co., prohibiting manufacture and sale by this company of such rims.

12—Plants of H. J. Walker Co. and Briggs Mfg. Co., Detroit, moved to Cleveland, to handle Chandler body work.

12—Chalmers Motor Co. ships $3,000,000 of cars in February. Biggest day was Feb. 29, when 193 cars were shipped.

16—Cadillac Motor Car Co. ships 25,000 Cadillac eights since company commenced manufacturing model in October, 1914.

17—H. J. Koehler S. G. Co., Newark, N. J., raises price of truck from $940 to $955.

18—Saxon Motor Car Corp. raises price of roadster and touring car from $785 to 815.

18—Willys-Overland Co. ships 27,683 Overland and Willys-Knight cars in first 2 months of 1916, as against 10,240 for same period in 1915. During January, 1916, 12,393 cars left factory, as compared with 4613 for the same month of 1915.

20—Wyman & Gordon Co., Worcester, Mass., reorganized with a capital of $3,000,000, and name changed to Wyman-Gordon Co.

20—Studebaker Corp., Detroit, increases output from 300 a day to 400.

21—Great Britain bars automobile imports.

21—Perlman Rim Corp., New York, secures two plants for manufacture of demountable rims.

21—Warner Auto Trailer Co., Beloit, Wis., to make trailers.

21—Nordyke & Marmon Co. increases price $200, bringing five-passenger model to $2,900 and seven-passenger car and three and four-passenger roadster to $2,950.

21—Solid tire suit ends. Court of Appeals affirms $210,000 judgment in favor of Kelly-Springfield Tire Co. against Diamond Rubber Co., on Grant patent No. 554,675, issued Feb. 18, 1896. Litigation has extended over period of 20 years.

23—F. B. Stearns Co., Cleveland, advances prices $50.

23—Pierce-Arrow Motor Car Co., Buffalo, increases wages 10 per cent.

27—Kemco Electrical Mfg. Co., Cleveland, reorganized.

28—Briscoe Motor Corp., Jackson, Mich., disposes of Argo Motor Co. plant in Jackson to Mansell Hackett.

APRIL

1—Michigan supreme court reverses decision awarding $20,000 damages to W. A. Paul, who claimed he invented curtain holder for inside curtains of automobile s, in a case against J. N. Collins, J. A. Bennett and the Novelty Leather Works, Jackson, Mich.

1—Overland ships 47,465 cars in three months. Comes within 1,000 cars of equalling entire yearly output of 1914. Output in March was 19,780, compared with 7,005 in March, 1915.

1—Jordan Motor Car Co. to build $50,000 plant in Cleveland.

1—Guaranty Securities Corp., New York, formed to finance time sales of automobiles.

3—Chalmers advances prices on touring car and cabriolet $40, roadster $20. Pathfinder raises price $275. Anderson Electric raises price $100.

3—Splitdorf Electrical Co., Newark, raises price of Splitdorf-Apelco electric starting and lighting system $10.

3—S. F. Bowser Oil Tank & Pump Co., Fort Wayne, Ind., pays 6 per cent dividend to employees on February wages.

4—Ford builds 58,329 cars in March, 14,450 better than March, 1915. Average daily output was 2,243 cars.

5—Perlman Rim Corp. purchases entire capital stock of Jackson Rim Co., Jackson, Mich.

6—Bock Bearing Co., Toledo, reorganized and name changed to Bock Taper Roller Bearing Co.

6—Great Britain places a treble tax on all British automobiles, ranging from $21 to $630, according to horsepower. Doubles tax on automobiles 16 hp. or less and trebles on cars over 16 hp.

8—Detroit, Toledo, Flint, Jackson and Lansing build 328,366 cars in first three months of 1916. Detroit plants produce 238,076 cars. Production in 1915 for these cities was 106,000 cars.

8—Auburn Automobile Co. advances price of 6-38 from $1,050 to $1,085. Lesler four advanced $100.

10—A Hudson super-six negotiated 1 mile in 35.12 sec. on the Ormond-Daytona beach. Five other trials were under 30 sec.
10—Champion Spark Plug Co., Toledo, produces 1,111,623 spark plugs in March.
12—Automobile industry represents 28 per cent of capital in Detroit manufacturing. U. S. Census statistics for 1914 show 120 concerns making cars, trucks, bodies and parts. Produce 40 per cent of value of all manufactures in that city.
14—Mitchell prices increased $75 for the five and three passenger car.
15—Winton prices raised $200.
16—McFarlan increases prices $210.
17—Studebaker Corp. institutes service policy to increase fuel efficiency.
21—Sears-Cross lowers prices on speedometers $4.
21—Overland wages raised 4 to 10 per cent with a reduced schedule of hours.
24—Briscoe raises prices $40 on 4-24, $35 on 4-38, and $35 on eight.
24—Argo raises prices $20.
24—Monroe Motor Co. turns over Flint plant to General Motors Co. and takes possession of plants formerly occupied by Welch Motor Car Co., Pontiac. W. C. Durant severs connection with Monroe concern.
26—Murray Motor Car Co., Pittsburgh, formed to manufacture cars.

MAY

1—Davis Motor Car Co. takes over Richmond, Ind., plant of Westcott Motor Car Co., which moves to Springfield, Ohio, occupying the plant of the Buckeye division of the American Seeding Machine Co.
1—Brunswick-Balke-Collender Co., Muskegon, Mich., maker of billiard tables, to enter automobile tire manufacturing field.
2—Rittman gasoline patent assigned to the U. S. Government.
2—Doehler Die-Casting Co., Brooklyn, N. Y., acquires controlling interest in American Die Casting Co., Newark, N. J., which will be named Doehler Die-Casting Co. of New Jersey.
2—Ralph Mulford, driving Hudson super-six stock chassis at Sheepshead Bay, breaks all previous 24-hr. records, averaging 75.8 m.p.h. for 1819 miles. The world's record of 65.905 m.p.h made by Edge, who drove 1581 miles 1310 yards, at Brooklands in 1907; the stock chassis record made by Mulford and Patschke in a Lozier at Brighton Beach in 1909, 1196 miles; the non-stock dirt track record made by Patschke at Brighton Beach in a Stearns in 1910, 1253 miles; the non-stock speedway record made by Virbeck and Hirsch at Los Angeles in 1911, 1491 miles, were the previous records.
3—Goodyear Tire and Rubber Co. suit against Firestone Tire and Rubber Co., in which it was held that the latter's tire-making machines infringed the patents held by the Goodyear company, was decided in favor of the Goodyear company.
6—Allen Motor Co., Fostoria, Ohio, shortens working day to 8 hr.
8—Boston Artificial Leather Co., New York, changed name to Zapon Leather Cloth Co.
8—Ford production in April, 51,739 cars, as compared with 46,510 in April, 1915.
8—Studebaker Corp. ships 490 cars on April 29. Biggest single day's shipment of company.
8—First Stephens car made by Moline Plow Co., Freeport, completed.
8—Sparks-Withington Co., American Gear Co., and Argo Motor Co., all of Jackson, Mich., shorten working hours and pay same wages as before.
8—Willys-Overland Co. completes addition, adding 500,000 sq. ft., and bringing entire plant to 103 acres. Shipments average 900 cars a day.
9—Grant Motor Car Co., Findlay, Ohio, to move to Cleveland.
12—Willys-Overland sales gain 174 per cent in year ending April 30. Shipped 137,665 cars as compared with 50,258 in preceding period.
12—Packard acquires Krit plant in Detroit.
12—Standard Steel Tube Co., Toledo, Garford Mfg. Co. and Fisk Rubber Co. reduce working day to 8 hr. with increased pay.
13—Studebaker Corp. sells 16,952 cars in first quarter of 1916, as compared with 9,400 the corresponding period in 1915.
13—Pennsylvania Rubber Co. reduces price on Vacuum Cup and Ebony Tread tires $2 to $6.
15—France prohibits importation from the United States and England of automobile chassis.
17—E. G. Baker, driving Cadillac eight, crosses continent in 7 days 11 hr. 52 min.
20—American Automobile Assn. in favor of single car tax. Advocates Adamson bill.
27—Fiat Automobile Works locates factory in Budapest, Hungary. Factory situated at Kelenfold, in suburbs of Budapest, has been rented.

JUNE

9—Hanlon windshield patent declared invalid. Cases involved; Rauch & Lang Carriage Co. vs. W. H. Hanlon, J. R. Wardrop and Anderson Electric Car Co., and National Automobile Chamber of Commerce vs. W. B. Hanlon and J. R. Wardrop and Anderson Electric Car Co.
9—Hanlon windshield patent invalid. Injunction against N. A. C. C. members on use of windshield to be lifted. Involved patent No. 13,653, issued to W. B. Hanlon on Dec. 2, 1913.
13—National Automobile Chamber of Commerce approves service and repair parts policies; defines standard truck.
14—Monster $250,000,000 merger abandoned. Included Willys-Overland, Hudson, Chalmers and Fisk.
15—Litigation between the Universal Rim Co. and the Standard Welding Co. settled out of court, the Standard Welding Co. acknowledging validity of patents by paying back royalties and taking out 10-year license under patents.
27—French Government places 70 per cent duty on imports.
29—King eight covers 11,000 miles in 2 weeks in June on non-engine stop test, maintaining an average of over 32 m.p.h.

JULY.

3—U. S. Government receives bids on 2,000 trucks and 400 passenger cars for Mexico service.
10—Results of Saxon 200-mile non-stop test conducted in all parts of country show 206 cars traveled 61,800 miles, and grand average was 23.5 m.p.g. of gasoline and 175 miles to a quart of oil.
12—France lowers truck duty and admits American trucks on pre-war tariff, equivalent to 12 per cent of value. Passenger cars, however, 70 per cent import duty.
14—U. S. district court holds that no infringement of patent was present in the manufacture of the Eclipse-Bendix transmission drive by the Eclipse Machine Co. Suit was brought by the Bijur Motor Lighting Co. against Eclipse Machine Co. and Vincent Bendix.
14—Neville Steering Wheel & Mfg. Co., Detroit, absorbs Neville More-Room Steering Wheel Co.
14—Court rules Eclipse Machine Co., Elmira, N. Y., and Vicent Bendix, Chicago, entitled to Bijur license on starting motor gear.
14—C. W. Nash, retiring president of General Motors Co., together with Lee, Higginson & Co., purchase entire stock of Thomas B. Jeffery Co., Kenosha, Wis. Purchase price about $9,000,000.
20—United States automobile makers produce 754,902 passenger cars in first six months of 1916. Ninety-nine factories contribute; 96 per cent made in Michigan, Ohio and Indiana; Ford alone makes 298,900, Overland 94,477, others over 40,000.
20—Ford Motor Co. adds thirty-four branches.
20—England has standard truck design. Other countries standardize both cars and aviation engines.
22—Forty-three Saxon cars, racing in relays, establish a transcontinental relay record, arriving at San Francisco July 22, 6 days 18 hr. 10 min. after leaving New York. Average speed was about 25 m.p.h.
29—Marmon stock car, driven by S. B. Stevens, Walter Bieling, Robert Creighton, William Binz and Fred Barbour, cross the continent in 5 days 18½ hr., leaving New York July 23.

AUGUST.

1—Pathfinder twin six crosses continent on high gear, leaving San Diego July 3 and reaching New York Aug. 1. Seals by A. A. A. No attempt at speed record, average daily of 200 miles; total mileage 4921; 4 days no running; gasoline consumption 10.2 m.p.g.
5—Republic Motor Truck Co., Alma, Mich., adopts bonus system in plant.
7—Ford builds 533,921 cars in one year. Makes 225,768 more in 1916 than in 1915. Cars worth $235,000,000. Employs 31,036 men.
14—Ford drops retail sales.
15—Stewart-Warner Speedometer Co., Chicago, purchases the V-Ray Co., Marshalltown, Ia.
15—Chevrolet produced 54,700 cars during fiscal year ending Aug. 1.
15—Ford introduces new body styles.
21—Saxon employees get bonus ranging from 3 to 5 per cent of their yearly salaries.
21—Timken-David Brown Co., Detroit, purchased by the Timken-Detroit Co., and the manufacturing operations consolidated under the management of the axle company.
22—Fuel tests made by 200 representatives of Master carbureter show mileages such as 31.7 m.p.g. in Phoenix; 28, Boston; 24, Tulsa; 22.4, Salt Lake City; 22.3, Los Angeles; and 22, Denver.

SEPTEMBER.

5—Maxwell builds 532 cars in one day. Average production 400 cars daily.
24—Hudson super-six, driven by A. H. Patterson, Ralph Mulford and C. H. Vincent, crosses continent in 5 days 3 hr. 31 min., breaking transcontinental for the third time in year.
26—Goodyear starts new plan for retailing its tires. Number of dealers reduced. No exclusive territory.

OCTOBER.

2—Automobile industry gains 152 per cent in five years; 1909-1914 value of products is $632,831,000; gain, $383,629,000.
10—Ford car equipped with a Myla-Maker carbureter attachment, with top and windshield up and four passengers, makes 26.6 m.p.g. in test in Chicago.

NOVEMBER.

2—Truck output in 1916 is 58,000 for first six months.
2—Fisher Body Corp., Detroit, buys one of plants of the Regal Motor Car Co., Detroit.
3—Injunction holds up Ford profits. Dodge Bros. in suit seek to prevent investment of surplus money.
14—Bankers secure control of Hess-Bright Mfg. Co., Philadelphia.
20—Carl G. Fisher to build one-wheel tractor in Indianapolis.
21—Knight Tire & Rubber Co., Canton, Ohio, absorbed by Fabricord Tire Co.
20—Discher patent covering bumper bracket construction is held valid and infringed by the Auto Parts Mfg. Co., and a permanent injunction granted to the Gemco Mfg. Co. Verdict is by U. S. district court.
21—Springfield Body Corp. files suit against Fisher Body Corp., the Fisher company and Fred J. Fisher and Louis Mendelsohn, charging infringement of design of patents on Springfield-type body.
28—U. S. Wheel Corp., Chicago, Ill., formed to manufacture Baker pressed steel wheel.

DECEMBER.

1—Moto-Meter Co., Inc., New York, gets temporary injunction to stop Heat-Ometer Co. from making and selling Heat-Ometer and from using the word "Heat-Ometer," which was held an infringement on the trademark "Moto-Meter."
2—Cadillac Motor Car Co. sues Cadillac Auto Truck Co., asking that latter firm be restrained from use of name "Cadillac," "Cadillac Auto Truck Co.," or other name prejudicial to the interest of the Detroit company.
4—Any State may tax non-residents decided by United States Supreme Court in case of New Jersey vs. F. J. Kane. N. J. motor laws upheld.
8—Prest-O-Lite Co. awarded $2,541.45 damages by judgment in suit brought against Camille Bournonville and Ida Bournonville, Newark, N. J., for refilling and sale of Prest-O-Lite tanks and substitution of refilled tanks.
11—Ford Motor Co. wins decision against Stahlbrodt Co., Rochester, N. Y., holder of patent purporting to cover a certain type of windshield commonly known as zig-zag windshield in U. S circuit court of appeals, decision reversing prior ruling of lower court.
11—United States Army to have caterpillar tractors similar to those used in British army.
12—Ajax Rubber Co., Trenton, purchases Racine Rubber Co., Racine, Wis. Ajax capital increased.
13—Argentine Mercantile Corp., New York, formed to facilitate Argentine shipments. For co-operative trade in non-competing lines.

Financial

JANUARY.

6—Portage Rubber Co., Barberton, Ohio, shows profits of $129,000 for 1915, an increase of 46½ per cent. Sales amounted to $1,100,000, or 62½ per cent over 1914.

14—Ford Motor Co. of Canada makes $3,202,000 in 1915. Produced 24,500 cars. Plans 40,000 for 1916.

14—Ogren Motor Car Co. changes name to Ogren Motor Works. Capital raised from $25,000 to $1,000,000. Plans production of 3,000 cars for 1916.

15—Signal Motor Truck Co., Detroit, increases capital $85,000 to $450,000, composed of $300,000 common and $150,000 7 per cent cumulative preferred.

19—Springfield Body Corp. offers $750,000 8 per cent cumulative preferred to finance new Detroit plant.

25—Grant Motor Car Co., Findlay, Ohio, raises capital from $200,000 to $4,000,000, composed of $3,000,000 common and $1,000,000 7 per cent preferred. Earned in 1914 about $165,000. Shipped 4,000 cars.

29—Goodrich surplus $10,205,679, equal to 17.17 on common. Net sales during 1915 total $55,416,856, a gain of 32½ per cent.

FEBRUARY.

5—Splitdorf Electrical Co., Newark, N. J., shows profits in 1915 of $745,107, or 16 per cent on the $4,292,000 capital stock. Profits in 1914 were $388,921.

8—Briscoe offers $1,500,000 7 per cent cumulative preferred for subscription.

15—Continental Motor Mfg. Co., Detroit, declares 100 per cent stock dividend. Capital increased from $2,900,000 to $5,900,000.

17—Fisk Rubber Co. sales total $14,500,000 in 1915. Net profits total $1,791,579.

26—Studebaker net profits equal $9,067,425 in 1915. Sales total $56,539,006, a gain of $13,094,782. Sells 46,845 cars. Earns $8,236,930, equal to 29.6 per cent on the common.

24—Chandler Motor Car Co. profits total $922,217 for 1915, as against $321,821 in 1914. Has $1,613,616 in bank.

24—Pennsylvania Rubber Co. reports a $4,000,000 business for 1915.

MARCH.

4—Fisk Rubber Co., Chicopee Falls, Mass., has net profits of $1,791,579 in 1915, against $942,204 in 1914.

7—Chevrolet Motor Co. earns $1,653,686 in 4½ months ended Dec. 31, 1915. Cash in hand is $5,877,079. Produced 11,888 cars in that period.

8—Peerless Truck & Motor Corp., profits on trucks for 1915 total $2,555,773, equal to 22½ per cent on the capital stock.

8—U. S. Rubber Co. profits total $11,486,705 in 1915 as against $9,776,873 in 1914. Net sales for 1915 total $92,861,015 as against $83,678,613 in 1914. Has surplus of $2,882,048 as against $721,951 in 1914.

13—Willys-Overland shows income in 1915 of $9,870,678. Earns over 46 per cent on the $21,000,000 common. Profit and loss surplus $14,720,550 as against $7,651,931 in 1914.

18—Electric Storage Battery Co., Philadelphia, has income in 1915 of $1,360,748, equal to 8.37 per cent on $16,249,425 capital, compared with $1,103,237 in 1914, equal to 6.78 per cent on $16,250,000 stock. Surplus after payment of dividend totalled $710,784, as against $453,272 in 1914. Gross sales were $1,770,188 as against $1,395,793 in 1914.

18—M. & S. Gear Co., Detroit, maker of M. & S. differential, increases capital from $1,000,000 to $1,750,000.

18—White Motor Co., Cleveland, declares initial dividend of 1¾ per cent on $16,000,000 stock, placing stock on 7 per cent basis.

APRIL.

22—Goodyear issues $10,000,000 of new preferred to take care of increased output. To produce 25,000 tires a day.

JUNE.

26—Paige-Detroit earnings at rate of $1,500,000 per annum, or 150 per cent on the stock. Tangible assets are $1,604,497, or $15 per $10 share.

JULY.

10—Hupp Motor Car Corp. business increases 47.3 per cent over 1915. Employees increase 74.6 per cent.

20—$1,275,000 profit for Stewart-Warner Speedometer Co., Chicago, during six months ending June 30.

1—Willys-Overland Co., Toledo, earns $4,377,799 in four months ending April 30, 1916. Surplus is $4,192,144.

23—Packard earns $18,836,506 in seven years. Over $9,000,000 charged off for depreciation. Earnings for nine months of fiscal year amount to $6,050,000 as compared with $2,769,518 for 1914 and 1915.

AUGUST.

3—Chalmers assets increased 50 per cent in past year. Gained from $4,857,274 to $12,051,538. Surplus totalled $3,066,673 as against $1,010,422 in 1915.

1—General Motors Co. earned in 11 months ending June 30, $144,000,000 as against $86,000,000 in same period in 1916. Sold 121,133 cars in that period as against 68,604 in same period in 1915.

2—Studebaker earned $6,028,329 in six months ending June 30. Included $180,000 war profits. Common on 10 per cent basis. During the corresponding period in 1916 corporation's profits amounted to $5,774,074, including nearly $3,000,000 of war order profits.

SEPTEMBER.

4—Ford profits in fiscal year ending July 31 were $59,994,118. Had $100,000,000 surplus and $52,550,771 in banks. Gross business was $206,867,647.

13—Maxwell earnings gained 135 per cent in year. Net assets were $11,176,783 as against $3,500,000 in 1915. Cash on hand was $3,269,552 as against $2,652,628 in 1915. Car sales increased 88 per cent over 1916.

29—Reo Motor Car Co. and Reo Motor Truck Co. gross sales amounted to $27,884,000 in 1916, including 23,753 cars and 2,551 trucks. Passenger cars increased 33.08 per cent and trucks 33.38 per cent.

20—Saxon Motor Car Corp. profits are $1,316,273 for year ending June 30, or equal to $22 a share on the $6,000,000 stock. Output of company was 25,500 cars, an increase of 15,651 over 1915.

30—Packard surplus is $10,823,717. Gains, $6,206,419. Total assets increased $11,830,505. More than $6,000,000 added to surplus.

31—White Motor Co. for 6 months' period ending June 30 shows net profits of $2,635,784. Has surplus of $1,623,521, equivalent to 11 per cent on $16,000,000 capital stock. Total income is $2,760,923.

Obituary

FEBRUARY

23—Lewis R. Speare, president of the A. A. A. in 1909 and 1910 and president of Massachusetts State A. A. in Newton, Mass.

APRIL

8—Bob Burman, frequently characterized as the world's speed king, was killed at Corona, Cal.

MAY

13—Carl Limberg, racer, was killed at Sheepshead Bay, N. Y.

15—Ludwig Opel, German car manufacturer, killed at Verdun.

26—Georges Boillot, winner of the French grand prix in 1912 and 1913, was killed in an aerial battle with five German aeroplanes.

JUNE

1—James K. Stewart, one of the founders of the Stewart-Warner Speedometer Corp., Chicago.

JULY

15—Paul Smith, vice-president and general sales manager of the Chalmers Motor Co., Detroit.

SEPTEMBER

21—L. S. Bache, Bound Brook, N. J., first vice-president and general manager of the Bound Brook Oil-less Bearing Co.

OCTOBER

12—R. S. Crawford, founder of the Crawford Automobile Co., Hagerstown, Md.

20—Henry Splitdorf, inventor of the magneto bearing his name, in New York.

30—Hughie Hughes and Frank Galvin, killed at Uniontown race.

NOVEMBER

4—Philip Braender, president of the Braender Rubber & Tire Co., Rutherford, N. J.

Apperson Bros. Co. New $300,000 Factory

AS announced in THE AUTOMOBILE recently, Apperson Bros. Automobile Co. is now in its new $300,000 factory, the transfer having been effected without impairing production by keeping machines working up to quitting time and then moving them to their new location during the night. The main building of the new plant is 150 by 610 ft. and contains the machine shop and erecting department. The blacksmith shop is 40 by 128 ft. and is newly equipped throughout. The metal-working department, enameling room and rough stock rooms are in a building 110 by 230; boiler and engine room is 60 by 78, assembly and paint shops 160 by 245, test barn 34 by 118 and chassis test shed 38 by 254. Over 500,000 sq. ft. additional space is available in the new plant and further additions are already planned. The present capacity is 4500 cars a year.

New $300,000 factory group occupied by Apperson Bros. Automobile Co., Kokomo, Ind.

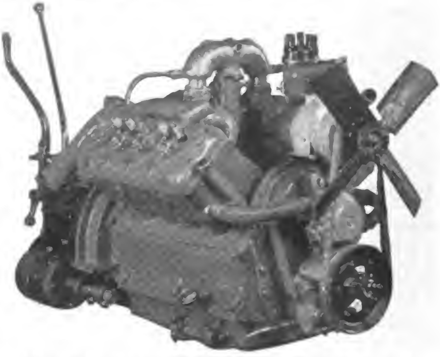
New Eight Succeeds Olds 44

Skeleton of Previous Model Remains but New Product Redesigned and Refined Throughout—Fan and Generator Combined

FUNDAMENTALLY the new Oldsmobile 45 is a continuation of the model 44 eight made last year. It has so many improvements, however, and so many parts have been redesigned that it may well be called an entirely new model. The general dimensions, such as the wheelbase, bore and stroke, etc., have been unchanged, but the details of the car have been altered in a great many respects and a great advance in engineering practice in the many considerations which go to make up performance, has been made.

What has been done may be realized when it is stated that with the same dimensions the power plant shows an increase of 25 per cent in horsepower. The present engine gives 56 hp. at 3200 r.p.m. The previous engine showed 45 hp. at 2800 and both are 2⅞ by 4¾. About the only thing that remains the same on the engine is the cylinder block.

This is a V-shaped unit with a detachable head and vertical-split crankcase. The head has been changed materially so that there is now more water space and the connection to the cylinder block is firmer. Three studs have been added to give a better connection and the head is carried over the cylinder wall to a greater extent, giving more water volume. Another point accomplished by the re-arrangement of the studs is that the strain given in tightening them, is removed from the valve seat so that there is no danger of distortion.



New Oldsmobile eight-cylinder 2⅞ by 4¾-in. engine, which develops 56 hp. at 3200 r.p.m. Note mounting of generator and ignition unit at front of cylinder blocks, generator and fan now being assembled together on the same shaft

While the Lynite pistons have been continued, the design is very different from a year ago, particularly in regard to the elaborate precautions taken to avoid oil pumping. There are three rings above the wristpin and one below. Six holes are drilled in the lower edge of the bottom ring groove and six in the upper edge. There are also two holes drilled diametrically opposite one another at right angles to the wristpin. The lower edges of the three upper ring grooves are chamfered as are top and bottom of the lower groove.

The present connecting-rod assembly weighs 17½ oz. This is a reduction over a year ago obtained by machining the rods all over. These are forked rods with square 2⅛ by 2⅛-in. bearings. The connection to the wristpin at the upper end is unchanged. The pin is locked in the piston boss with a set screw having a cotter pin in the center of the hollow wrist pin. This takes all stress off the cotter pin. The pin is not made of tube but is drilled from the solid piece.

A new crankshaft with a very complete counterbalancing system is now employed. Three counterweights are mounted on the shaft to take care of running balance. The shaft is also in static balance. The counterweights are electrically welded to the shaft after the latter is forged, the weld being a see-saw joint giving the greatest possible area of metal to metal contact at the connection. The shaft is carried on two main bearings, and is noteworthy for its shortness. The overall length is 25¾ in. The front bearing is 1⅞ by 2⅞ and the rear 2⅛ by 3¼.

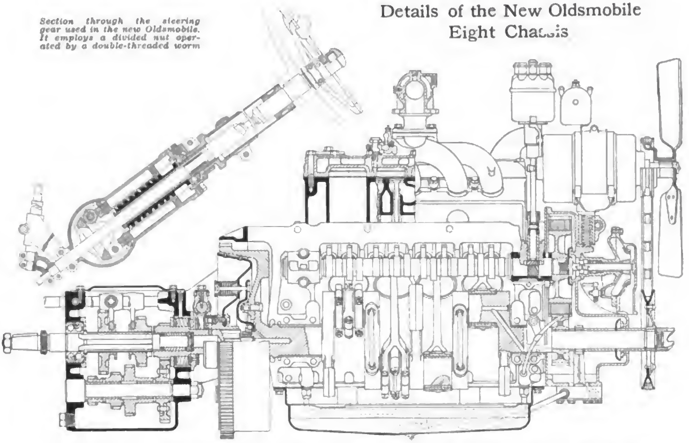
The entire front end of the engine has been changed. The valve drive is much the same except that a Fabroil gear is now used for silence, but the generator which was formerly driven by chain is now driven by belt, and is mounted on the same shaft as the fan. The generator and fan run on two bearings, a Hyatt roller and a New Departure double row ball, taking thrust and radial load. The two units are now assembled together while the fan was formerly a floating design driven from a spline shaft from the generator sprocket. The belt is a V type, ¾ by ⅝-in. section, riveted on lugs The ratio of the fan to the shaft is 1½ to 1. This ratio gives pulleys of large diameter and hence imparts considerably longer life to the belt.

A new adjustment for tension on the fan and generator belt has been installed. This consists of a hollow plunger which is integral with the generator bracket and working in the front gear cover. There is a spring behind the plunger which is held by a pinch bolt. When the pinch bolt is released the spring causes the plunger to take up the slack after which the pinch bolt is again tightened.

To take care of the timing gears more efficiently a change has been made in the oiling system. This is a pressure system and a new lead has been added to the main line by means of which oil under pressure is fed directly to the point of mesh of the timing gears. This forces a 3/16 in. stream directly to the desired point on the gear, after which it drains back to the crankcase reservoir.

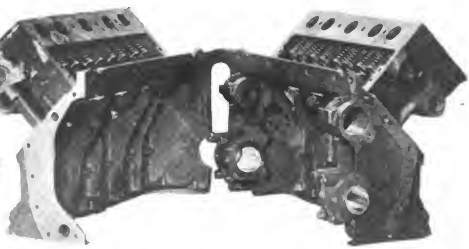
Another change in the oiling system is in the pump. This is now mounted outside of the front gear housing and can be taken off without interfering with any other part of the engine or even dropping the pan. The pump was formerly located in the front chain housing. It is now possible to take

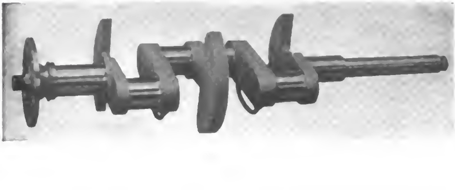
Details of the New Oldsmobile Eight Chassis



Section through the steering gear used in the new Oldsmobile. It employs a divided nut operated by a double-threaded worm

Section through the eight-cylinder unit power plant engine used in the new Oldsmobile eight, showing connecting-rod mounting, details of lubrication scheme and attachment of clutch and gearbox. The engine is 2⅞ by 4¾ and is credited with 25 per cent more power than the model previously employed

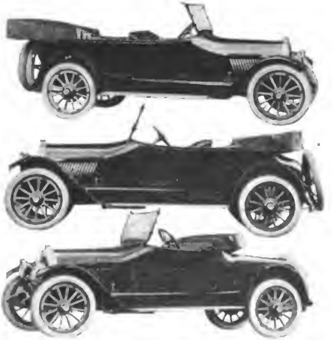




Above at the left is the piston and connecting-rod assembly

At the right castings of the new engine, showing the patented feature of having four cylinders block cast with half of the crankcase and bearings in the left hand block

At the left is the new crankshaft, which is very carefully counterweighted for both running and static balance



Upper—Oldsmobile eight-cylinder seven-passenger touring car
Middle—New four-passenger club roadster on same chassis
Lower—Two-passenger roadster, with convertible rear compartment with folding top, providing a seat for two additional passengers

off the pump in 5 min. Another point of simplification is the placing of the oil regulator in the crankcase. This is particularly good from a manufacturing standpoint as it cuts out three unions in the piping.

With the exception of the use of flexible pipe instead of rigid from the vacuum tank to the engine, the gasoline system is the same as a year ago. The object of the flexible hose is to eliminate the effects of non-synchronized vibration. As the engine is mounted flexibly in the frame it is natural that any connections between the chassis parts and the engine should be preferably flexible.

In the cooling system the greatest improvement is in the cylinder head. The radiator has also been changed and is now an oval shape of very distinctive appearance. The capacity of the present cooling system is about 5 gal. as compared with 4½ gal. on the previous model. The pump and pump drive have been improved. The drive is an ingenious sheer-clip scheme in which the drive is taken from the nut holding the camshaft gear in place. The clip is slipped into the slots of two shafts which come end to end and being the weakest part of the drive; in case the pump should freeze the clip would shear,thus preventing harm to any other part of the system.

The pump housing is now attached by an oval flange to the front gear cover, giving a rigid connection. Formerly the pump was supported directly on the camshaft and was hence a floating type. An all rubber hose connection is now used instead of a metal elbow.

Some miscellaneous points which should be mentioned in connection with the new cylinder head are the location of the spark plugs which are now over the intake, and the fact that the center line of the valves is inclined at an angle of 8 deg., 55 min. to the center lines of the cylinders. Better combustion is said to result from the first and better gas flow from the second.

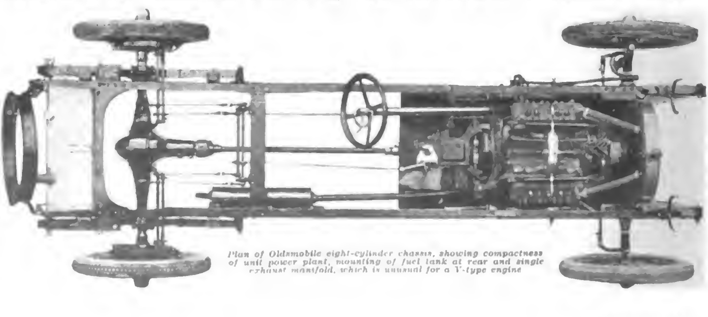
No changes are to be noted in the clutch. This is a cone with four engaging springs and no adjustments. Beneath the facing there are easy engaging springs. A clutch brake is formed by a pad on the front end of the transmission and the throw-out is a ball design. The clutch diameter is 12½ in. maximum.

The gearset also remains unchanged. This is a three-speed box with a four-spline main shaft mounted on a Hyatt roller at the front end and a New Departure double row at the rear. The shafts and gears are chrome nickel steel with ¾-in. face on the sliding gear and 1 3/16-in. face on the constant mesh gear. On the main shaft the bearings are close, giving only 7 ⅛ in. of unsupported shaft. A long Hyatt roller is used for the spigot bearing and the lay shaft is carried on two bronze bushings.

Two Spicer universals are just being added to the drive. The shaft is hollow and is slightly larger in section than last year in order to take care of the greater torque of the improved engine, being increased from 1½ to 1¾ in.

An increase in gear ratio has been made this year in the touring rear axle. This is now 4 11/12 to 1; it was 4 5/12. The pitch is 4½. A truss has been added to the axle to brace it against strain. This is adjusted by a heavy turn buckle beneath the differential housing. The rear springs are the same 48-in. three-quarter elliptics in the rear, but the front springs have been flattened. A detail is that the leaves are now diamond pointed instead of straight cut as formerly.

In the frame construction, the same layout is used with the exception of the front end where the trunnion support of the engine has been given up and a special cross member used instead. The three point effect is retained, however, with the new layout. Another detail is in mounting the front springs; the castor effect is secured by mounting them ahead of center. These are 36-in. springs and 17 in. is ahead of the clip center



Plan of Oldsmobile eight-cylinder chassis, showing compactness of unit power plant, mounting of fuel tank at rear and single exhaust manifold, which is unusual for a V-type engine

with 19 in. behind. Both drive and torque are taken through the rear springs.

There are four bodies in the new series, a seven-passenger touring, five-passenger touring, four-passenger club roadster and a two-passenger roadster, the rear compartment of which can be converted into an extra seat for two passengers. Taken with the new German silver trimmed radiator, new flared mud apron and grooved lamps, matching the radiator, an attractive appearance is presented. The prices of these models are $1,295 for the seven-passenger touring and $1,295 for all the others.

Many Colors Available

The upholstery is long grain, bright finish French leather, box plaited and stuffed with close-nested, small diameter springs, incased in linen sacks. The cowlboard is Circassian walnut with silver finished instruments mounted flush. The steering column is nickeled, with a walnut wheel.

A wide variety of color is offered, the seven and five passenger cars being in royal green, the club car is royal blue and the convertible roadster in carmine, with the above colors optional for any model at a slight additional cost.

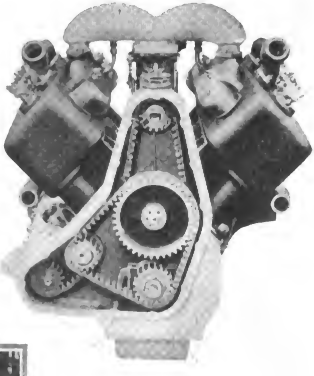
Driver's compartment of Oldsmobile eight, showing large seat, conveniently arranged instrument board and control members

Majestic Makes Two Eights

Extremely Luxurious Bodies Leading Characteristics of New Production

THE Majestic cars, made by the Majestic Motor Co., New York, are among the list of new cars announced in December. There are two chassis, one with 125-in. wheelbase and a 3 by 5-in. eight-cylinder engine selling for $1,550, and the other, which costs $3,000, has ten inches more wheelbase and an eight-cylinder engine 3¼ by 5 in. The two chassis depart but little from good conventional practice and appear to be laid out nicely, while they are of a sturdy character.

The appearance of the cars is unusually distinctive, largely because of the rounded radiator and specially designed headlights. A tilted windshield and double cowl are employed. The tonneau embodies several features which should appeal to the discriminating owner, particularly if he does much touring. The front of the rear seat is a mahogany paneled compartment, the interior of which is large enough to hold several lunch boxes, dusters and other articles. The door lifts up with lock hinges, forming a table so that the lunch may be comfortably eaten right in the car. At the right is a compartment fitted with a vacuum bottle and a cigar lighter. At the left there is a compartment containing a vacuum ice and solid food container. The tonneau equipment also includes a lady's toilet set and the usual robe rail and cushion foot rest. The carpet is lined on the bottom with a waterproof oilcloth which may be turned over in wet weather, thus saving the carpet.



The engines used on the Majestic chassis are both eights, of L-head type, and have this silent chain layout for the front ends. The idler sprocket shown on the left furnishes the adjustment for the triangular drive from the crankshaft, the sprockets for the generator and for the fan being adjustable separately

Very luxurious bodies with a lavish equipment of accessories and fittings are supplied. The car shown on the left sells for $1,550 with a one man top instead of the Victoria type illustrated

Flexibility in Hydraulic Transmission

Radcliffe Hydraulic Transmission Acts as Clutch, Eliminates Need for Intermediate Gear and Gives Electric Flexibility to Drive—Can Stop and Start on High Gear by Throttle Movement Only

THE Radcliffe hydraulic transmission may be described briefly as a hydraulic clutch which automatically gives a similar effect to that obtainable from an electric transmission. With it a car can be started from rest on high gear without any shock or difficulty, merely speeding up the motor causes the car to move forward, and the car can be stopped on the brake without stalling the engine. Its flexibility can best be demonstrated by taking the car on a grade where, without manipulating anything except the throttle pedal, it is possible to go forward, to allow the car to run backward, to arrest it and start it forward again without touching either brake or gear lever. It is anticipated that this transmission will eliminate the necessity for an intermediate gear ratio, although it is not suggested that it removes the necessity for an emergency low speed.

Replaces Clutch

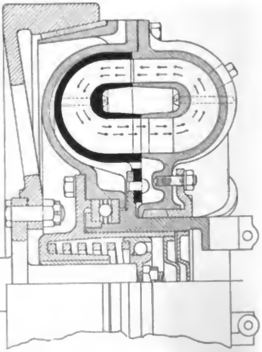
The device replaces the ordinary clutch. It consists of an aluminum or pressed steel casing provided with turbine blades in the manner shown in the illustration. The driven member has similar corresponding turbine construction and the whole case is filled with oil. Assuming the driven member to be held stationary, as it would be when in connection with the road wheels of a stationary car, if the engine is running slowly the oil will circulate around the turbine blades but will offer very little resistance. As soon as the engine speeds up the rotating part of the turbine forces the oil with considerable pressure into the stationary part, which is thereby caused to follow it, and as the car gains speed the difference in rate of revolution between the driving and driven member will gradually decrease until there is very little slip indeed.

The secret of success of the device really lies in the detail design of the turbine members. On meeting a hill the slip increases a little, thus allowing the engine to maintain its speed, and although, of course, a certain amount of power is lost in heating the oil the flexibility given in this way will provide the equivalent of an intermediate gear ratio. It is practically only when actually starting on a stiff grade that it is necessary to engage a low gear.

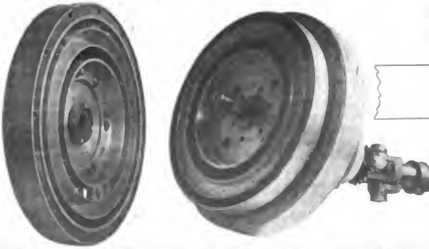
The development of the transmission has taken a good many years, experiments being directed mainly toward ascertaining the proper shape and proportion of the turbine blades. Consideration of the photographs and of the sectional drawing will show that the impeller discharges directly into the runner and that the oil then passes back again into the impeller.

It will be noticed, of course, that there is a stuffing box at the center where the driven shaft comes out through the driving casing. It might be thought that this would require to be extremely tight, but such is not the case, because the transmission is not filled completely with oil. A little air is left inside and as soon as the engine starts to run the centrifugal force carries the oil outward, thus bringing the air to the center and taking away all the oil from around the gland.

The final experimental model has been in use for over 6 months on a six-cylinder Studebaker and is being handled by the A. Elliott Raney Co., 244 West Fifty-ninth Street, New York. In the several thousands of miles of driving no hill work has ever caused the oil to heat unduly and the gasoline consumption over a long period is closely similar to the previous record of the same car with the gear transmission. The transmission is very practical for manufacturing.



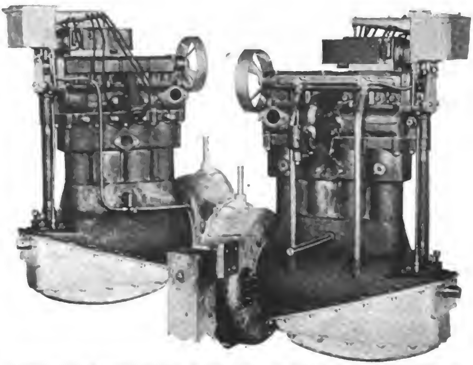
Section of Radcliffe hydraulic transmission combined with cone clutch to fit six-cylinder Studebaker car used for experiments. The arrows show the direction of oil flow



Left—Impeller of Radcliffe transmission showing curved blades. Right—Back half of casing and the runner or driven member

Nelson Is Unique Design

37 Miles Per Gallon Claimed for $2,200 Car—Overhead Camshaft and Original Transmission—Weight Kept Low



Nelson four-cylinder block power plant, which has an overhead camshaft. The unit gearbox incorporates clutch, gearset and rear axle gears. Bore is 3⅛ and stroke 4¾ in.

FOR 4 years, E. A. Nelson, the engineer who designed the well-known Hupmobile 20 runabout made during the years of 1910, 1911 and 1912 and the model 32 which succeeded it, has been working on a car of its own. This is now ready and the first finished jobs have been shipped to Eastern points, where distributors have already been engaged.

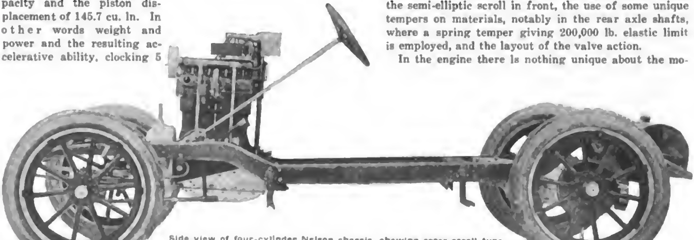
The Nelson cars are not only distinctive mechanically but otherwise also. The cars are not made by a company but by Nelson himself, financed with his own money and manufactured in his own plant in Detroit, which has a capacity of ten cars a day. There is no stock for sale and no intention of organizing a stock company. It represents the effort of an engineer desiring to place on the market a light-weight vehicle of economy, made from high grade materials, with price occupying a rather subdued position.

The result is a vehicle weighing 2200 lb. with the tanks empty, claimed to be able to travel 37 miles to the gallon and to average better than 25, selling for $2,200 with a sedan body. From one end to the other the design is distinctive, although there is nothing radical. A great number of patented features are used, however, and the finished product shows the result of a considerable amount of study of detail which has resulted in many ingenious departures.

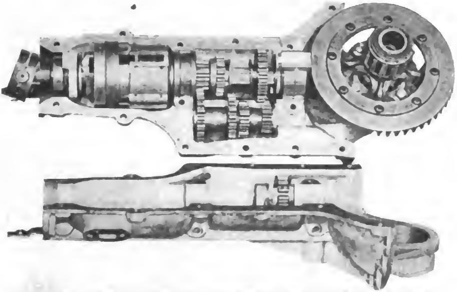
In working out this design two ideas were kept uppermost, the five-passenger capacity and the piston displacement of 145.7 cu. in. In other words weight and power and the resulting accelerative ability, clocking 5 to 35 m.p.h. in 13.5 sec., checks up the results. Throughout, the materials have been designed for this particular capacity with a particular eye toward economy, which means lightness. The finished vehicle carries only 3 gal. of water and 5 qt. of oil, 2 of which are in a reserve tank.

Some of the high spots on Nelson's car are the overhead camshaft used on the block four engine, the unit transmission incorporating in one housing the clutch, gearset and rear axle gears, the cross scroll spring in the rear and the semi-elliptic scroll in front, the use of some unique tempers on materials, notably in the rear axle shafts, where a spring temper giving 200,000 lb. elastic limit is employed, and the layout of the valve action.

In the engine there is nothing unique about the mo-



Side view of four-cylinder Nelson chassis, showing cross scroll type of rear spring having its center support mounted on a tubular cross member at the rear of the chassis. Wheelbase is 104 in. and tires and 32 by 4. Note mounting of engine



Unit gearbox used on the Nelson four incorporating in one housing the clutch, gearset and rear axle gears. This housing is made of aluminum

tor block itself. This is an iron casting with the upper part of the crankcase integral. The heads are detachable, carrying the entire valve assembly and the manifolds, and above the head there is an additional cap carrying the camshaft assembly, also acting as an oil housing for the latter which runs in a continual bath.

In the piston and rod assembly there is nothing exceptional but the rod section. This is a shallow I designed for extreme stiffness in the plane of rotation without a mass of material on the flanges for perpendicular strength. The piston is iron and carries four rings. These are in two slots, each slot carrying two rings of the ordinary eccentric type with the rings dowel pinned to the piston to hold the slots at opposite points on the circumference to avoid leakage. The rings are thus locked in pairs.

The piston pin is hollow, 1 in. in diameter, locked in the upper end of the rod by a pinch clamp and taking its bearing in the piston bosses directly without bushings. The bearing space is 1 in. in diameter and 1 in. on each side, giving a total dimension of 1 in. diameter by 2 in. length. The I-beam rod has a flange width of ⅜ in. The depth of the I is 1⅛ in. at the center with a taper toward the bottom. The stock used is 3/32 in. through the center of the web, the material being chrome vanadium steel. The rod length is 10½ in., and the weight of the entire assembly of piston and rod is 3 lb. 2 oz. Without the piston the rod assembly weighs 1 lb. 12 oz. The bearing at the lower end is 2 in. in diameter and 1½ in. long, provided with two 3½ nickel steel cap bolts.

A counterweighted crankshaft is used, the particular feature of which is the thickness of the cheeks. The thickness of these on the sides adjacent to the two center bearings is 2 7/16 in. The counterweights are made up to balance the throws, plus one-half the rod weights. The material used in the shaft is 0.40 carbon steel, with the counter-weights electrically butt-welded into place.

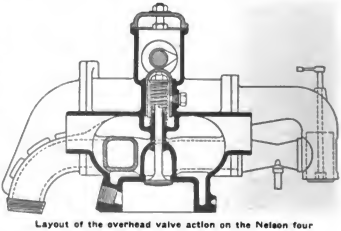
From the crankshaft the valve drive is carried to the overhead camshaft by bevel gear and vertical shaft. The bevel gear is mounted directly on the rear end of the crankshaft and housed directly in the rear main bearing. This is a chrome-silico-manganese, commonly known as C. S. M. steel gear. The vertical shaft tapers from ⅝ in. at the gear to 9/16 at the top and has a 1 to 1 ratio with the crankshaft. The half-time ratio is secured at the top, where an adjustable spiral bevel transmits the drive to the camshaft. Back of the camshaft spiral bevel gear is a spur gear which forms the magneto drive, the instrument being mounted on the top of the engine and being a special Bosch arranged so that the magnets lie flatly on the top of the cylinder head.

The camshaft lies directly in the head piece of the engine. At the rear end is the spiral gear through which it is driven and at the forward end is the fan pulley which it drives. It is a short, stiff shaft, carried on five bearings cut directly in the cast iron. The camshaft can be slipped into place from either end and carries the cams integral. These are the true, constant-acceleration type, designed to run with 0.005 clearance and giving conventional timing with no provision for valve adjustment. The heads of the hollow tappets and the valve stems which fit into the tappet are ground to finished accuracy after which no adjustment is required. The intake opens 15 deg. after top center and closes 35 deg. after bottom center. The exhaust opens 45 deg. before bottom center and closes 10 deg. after top center.

Across the diameter the camshaft measures 1⅝ in. at the bearings. The three center bearings are ¾ in. long and the end bearings ⅞ in. This is a low carbon steel shaft hardened at the rubbing point. A piston type of tappet is used fitting around the valve stem. The tappets are pressed steel hardened and ground, 1⅛ in. diameter, with the follower ground to a true radius. The valve drive operates with a 28-lb. spring.

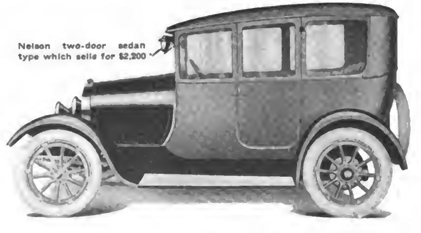
Full pressure oiling is used running up to 30 lb. per sq. in., with an exterior adjustable release. No splash is used to any of the bearings, the oil being circulated through the hollow crankshaft and with an independent lead directly to the camshaft housing, where it keeps the shaft bearing continually bathed in oil. This circulating system is operated by a pump formed by the drive gears at the lower end of the vertical valve shaft and has a capacity of 3 qt. In addition to this, there is a small tank mounted on the top of the engine having a reserve capacity of 2 qt. which can be allowed to flow into the main reservoir whenever the oil indicator shows no pressure.

A special adaptation of the U.S.L. starting and lighting system is used, in which the unit is mounted, as customary, as a flywheel at front end of motor. The fields are stationary, with the armature rotating and forming the flywheel. The hub for the rotating member is a standard taper fitting on the end of the crankshaft, while the stationary member is carried on a projection of the crankcase. This



Layout of the overhead valve action on the Nelson four is a 12-volt system with inherent regulation. Ignition is by the specially-built Bosch instrument and the storage battery is a U.S.L.

For carburetion a Zenith instrument is used with a vertical flange directly against the cylinder head which contains the integral manifold. The carbureter is featured by an inclined header designed to eliminate the pocket found with a horizontal header at the venturi and patent has been applied for on this feature. The economy of the car focuses around the construction of the intake manifold, which is so formed that the longest draw from the carbureter to the farthest intake port is 4 in. The water around the cylinder head is kept at about boiling temperature, summer and winter, thus giving the heat required with the present grade of fuel and allowing operation with anything that is called gasoline. Another feature about the throttle linkage is that it is laid out to give a uniform opening at low throttle position.


Nelson two-door sedan type which sells for $2,200

Cooling is by thermo-syphon with a cellular radiator which has a feature of note in that the overflow pipe is carried to the bottom of the radiator, allowing the steam formed in case of a gathering of slushy ice in the bottom to thaw out the cooling system.

The clutch receives its drive from a shaft and single universal, being mounted in unit with the gearset and rear axle. The diameter of the clutch is 3¾ in. and it is comprised of thirty disks of saw steel running in oil. The axle is floating with ⅞ sq. in. chrome vanadium steel shafts, heat treated with a spring temper giving 200,000 lb. elastic limit. The housing for the clutch, gearset and transmission part is aluminum, and the gear reduction at the rear axle is 4.25 to 1. The propeller shaft is 11/16 chrome vanadium steel.

A cross scroll type of rear spring is used with the center support mounted on a tubular cross member at the rear of the chassis, giving a slight compensating or rocking action. The scrolls at the ends of the spring serve as centering devices and supplant the shackles. On the front springs the scrolls are also used and they serve to take up the shock between the frame and the spring and also give a flexible drive to the front axle.

There are six cross members in the frame, those at the front and rear being tubular. The steering gear has a divided drop arm which equalizes the bearing stresses on this point. There is also a forked wheel spindle which distributes bearing stresses and takes care of the castor effect. Additional castor is given by mounting the springs ahead of center, the distance being 16 in. front and 18 in. rear. The brake linkage also has a little kink of interest in the use of sectors for expanding the bands. The brakes are both expanding, being side by side on the same drum. The diameter of the latter is 11½ in. and the face width 1¼ in.

The wheelbase is 104 in. and the tire size 32 by 4. It is stated that upward of 12,000 miles has been shown on the test cars to a set of tires. The speed range is from 5 to 50 m.p.h.

It will be noted that in the body lines the cowl is entirely eliminated, the hood being in direct contact with the body proper. It is a two-door sedan type with divided front seats, upholstered in gray bedford cord, as is also the top lining. The cushions are tufted with real curled hair over heavy springs. All the windows can be lowered into the body sash and a double windshield is employed. Standard equipment includes a Moto-Meter, Stewart speedometer, Waltham clock and ammeter, gasoline and oil gages, dash light, tools, tire pump, etc.

Chalmers Six Hauls 15 Tons ¼ Mile

INSTALLATION of heavy machinery at the big automobile plants presents problems that only resourceful factory managers can solve.

During the fall a big steam hammer arrived at the plant of the Chalmers Motor Co., Detroit, for installation in the drop-forge building. The steam-hammer weighed in excess of 15 tons, and after being unloaded from a railroad flat car, had to be moved a distance of ¼ mile.

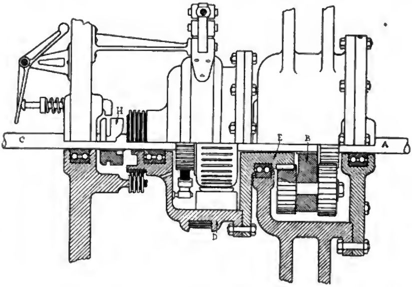
A Chalmers Six-30 chassis was hurried over from the final test department, hooked up to the big hammer by heavy ropes and the power was turned on. So heavy was the ponderous piece of machinery that steel rollers placed under it were crushed like egg shells and the ropes lasted for only short periods.

But the 2000-lb. chassis moved its 30,000-lb. load along steadily and the hammer was in position within an hour after arriving at the factory.

Chalmers Six-30 chassis hauling a 15-ton steam-hammer ¼ mile to factory

A Cuban Electric Transmission

Electric Unit Combined with Planetary Gear Permits Reduction of Size and Weight—Direct Drive Given by Engaging Dog Clutch



TO the possibilities of electric and electromechanical transmission systems there seems to be no end. One of the most interesting is illustrated on this page. It has two special advantages; first, it gives a direct drive on high gear, both the electrical and mechanical portions then being inoperative. Second, the horsepower of the electrical portion needs only to be one-half that of the gasoline engine. The action can be very readily followed from the sectional illustration in which *A* is the engine shaft. It will be seen that this drives the sun wheel of a planetary gear. The armature of the electrical machine and the pinion carrier *B* are both fixed to the shaft *C* which is the driven shaft to which the universal joint is attached for the propeller shaft. The field magnet case *D* turns freely on the shaft *C*, but has integral with it a second sun wheel *E*, being thereby connected to the engine through the medium of the planet pinions which are both on their shaft.

Now assume *A* to be rotating and *B* stationary, then the pinions will revolve, and *D*, by means of the sun wheel *E*, will be driven in the same direction as that in which the engine is turning at a speed depending upon the numbers of teeth in the sun wheel on *A* and the sun wheel *E*. Having the field magnets revolving around the armature, as soon as a current is allowed to flow there will be resistance, so that the magnets will tend to drag the armature around with them. This is the equivalent of applying a magnetic clutch tending to start the car by means of the shaft *C*. But there is also the reaction to be considered. The field magnets tend to rotate the armature and the armature tends to stop the rotation of the field magnets. This means that equal efforts are being made, one to turn the shaft *C* and the other to stop the turning of *D*, and so to stop the turning of *E*. The effect of holding *E* is to produce another reaction which drives the pinion carrier *B* in a forward direction. But *B* is keyed to the shaft *C*; therefore, we are trying to turn this shaft both by means of the armature and by means of the pinion carrier, and the turning effort is divided equally between the armature and the planetary gearing.

As the car speeds up we shall reach a position where the shaft *C* is revolving a little slower than shaft *A*, the difference in speed being only just sufficient to maintain enough current to supply the necessary magnetic grip. When this happens the throttle is allowed to close for an instant and the dog clutch *H* is moved by any convenient means, this locking *D* to the shaft *C*. Then no current is being generated, since the armature and the magnets are revolving at the same speed and there is no relative motion between the different parts of the planetary gear.

To obtain the reverse there is a brake band surrounding *D* whereby it can be stopped from rotating and *E* being stationary will cause the pinion carrier *B* and shaft *C* to travel in a reverse direction.

This is merely the simplest expression of the invention, which is susceptible to many variations of detail. The inventor is Carlos M. Seidel, an electrical engineer of Havana, Cuba, at present residing in New York. He is anxious to make arrangements for the manufacture of an experimental outfit and may be addressed in care of THE AUTOMOBILE.

New Process Rubber—Plates Metal

Soft Rubber Attached to Steel So That It Cannot Be Torn Off—Employed for Solid Tire Making and New Flexible Coupling

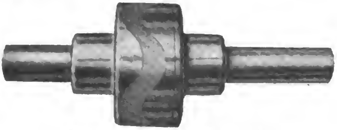
THE attachment of rubber to metal is a subject which probably is not much considered by engineers, yet for many purposes a process which enables soft rubber to be fixed to steel is very useful. The first instance that occurs is, of course, an electrician's pliers where the rubber is necessary for insulation. Another place where the two dissimilar substances require to adhere is in the band type of solid tire. Yet another example is the roller skate wheel, for skates intended to be used in offices.

The old way of attaching rubber to metal was to make the metal surface very rough so that the rubber, when vulcanized in place, would be held mechanically by the rough metal. A new process has recently been developed by the Rubber Insulated Metals Corp., Plainfield, N. J., whereby soft rubber can be made to stick to metal so strongly that the rubber can be torn off afterward and will break above the junction line rather than at it.

To obtain this close adhesion, it is not necessary that the metal should be very rough. The first stage consists of plating the surface of the steel with a copper alloy having very much the appearance of brass. Then, in mixing the rubber previous to vulcanizing, certain substances are added which have a chemical action on the copper alloy when subjected to the vulcanizing heat. Vulcanizing proceeds exactly as though the metal were not there. In the case of a pair of pliers, for instance, after they had been plated the rubber compound would be put on the mold and vulcanizing then takes place at the same temperature in about the same time required formerly. Repeated experiments show that after this treatment the rubber can only be torn off with difficulty, and when as much as possible has been removed in this way it will be necessary to scrape or cut in order to get down to the metal surface, so strong is the tie between the metal and rubber that is established during vulcanizing process.

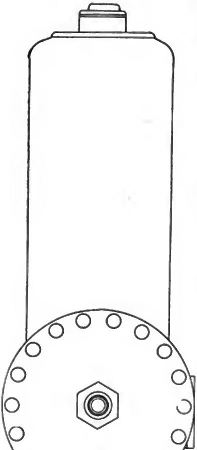
There seems to be hardly any end to the possibilities of this process. One of its most useful fields of application is claimed to be in solid tire manufacture, the Rubber Insulated Metals Co. stating that a tire with a given amount of rubber of a given quality can be produced more cheaply by their method than by any other. In other words, they think the process will effect a substantial economy in solid tire cost.

Another use for the process is for making flexible couplings, and it is anticipated that there will be a big demand for these in the automobile industry. The coupling is shown in the accompanying illustration and there is no metallic connection whatever between the two steel parts. The wave formation of the steel is carried right across and a half inch or more of rubber, according to the size of the joint, separates the two metal parts. These joints have been made in many sizes and tested in many ways and should have many automobile uses. In this coupling the rubber is normally in compression, as can be observed by looking carefully at the illustration. It is not suggested that the joint is flexible enough for use where much disalignment exists, but it will care for as much as a leather disk magneto coupling.


Rimco rubber-metal flexible coupling

Carter Tank Pumps Fuel

Diaphragm Oscillated by Cylinder Pressure—Keeps Level Constant—Action Unaffected by Throttle Position

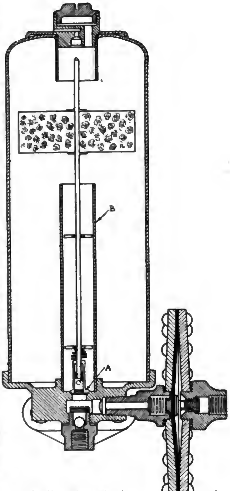


THE Carter system of fuel feed used on the American six, and applicable to any automobile, is a positive pumping system operating without regard to the depression in the intake manifold and also making no use of exhaust pressure. Its essential feature is a diaphragm something like the vibrating diaphragm of an electric horn. This diaphragm is contained in a case and on one side of it there is a spring which normally keeps it pushed back against the opposite side of the case. Here there is a small hole in which a little plunger rests, and behind this plunger is a connection for a copper pipe, of which the other end is taken to one of the cylinders of the engine, usually being fitted to a union in a valve cap or some similar convenient place.

Diaphragm Protected from Explosion

On the compression stroke the air in the pipe is compressed in proportion with that in the cylinder. This moves a little plunger and presses the diaphragm across its case against the spring. When it is pressed as far as it will go the little plunger comes against a seat in the nipple so that when the explosion follows the compression it merely holds the plunger more tightly on its seat and does not transfer any more pressure to the diaphragm. As soon as the pressure drops in the cylinder on the exhaust or suction stroke the spring drives the diaphragm back again to its original position. Thus, during each cycle in the cylinder to which the diaphragm is attached, it makes one complete oscillation. The side of the diaphragm case furthest from the engine is connected by a non-return valve to a long pipe and the gasoline tank. It is also connected with the small tank by which the carbureter is fed. As the spring pushes the diaphragm back, when the cylinder pressure falls it sucks in fuel from the main tank, then on the next compression stroke this fuel is driven upwards into the supplementary tank passing another non-return valve as it goes. It is by means of this second non-return valve that the pumping is caused to cease when the supplementary tank is full.

Referring to the illustration, the valve being shown at *A*,



Section through the Carter tank

it will be seen that it is a mushroom type and on the compression stroke of the diaphragm the fuel is forced upwards until it entirely fills the vertical tube *B* and flows out over the top into the tank. When the level in the tank lifts the float the stem of the latter raises the little plunger *C*, which is inside the mushroom valve. Thus, at the top of its travel the float lifts the mushroom valve off its seat. As soon as this happens the diaphragm, instead of sucking fuel from the main tank, merely draws it from the supplementary one and pumps it back again.

To start the tank, originally when it was first fitted the priming cap at the top of the tank is unscrewed and the gasoline poured in. Once the lower part of the tank is filled it will require no further attention.

The Carter tank is made by the Carter Carbureter Co., St. Louis, Mo.

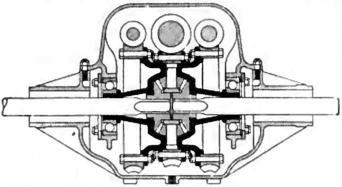
A special claim made for the Carter system is that the fuel level remains very constant. Less than ⅛ in. of movement on the float will make all the difference between the mushroom valve being closed or open, and as this leaves its seat the pump is instantly stopped and as instantly started when it once more returns to its normal position.

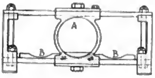
Multiple Worm Drive Axle

Two Direct Speeds and Reverse, Also Direct, Inside Axle Housing

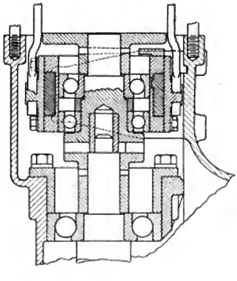
THE illustrations on this page show a multiple worm drive axle giving two direct speeds forward and a direct reverse. The propeller shaft is inclosed within a very large diameter torque tube, and there is an ingenious device whereby the rear end of the shaft can be direct clutched to either of the three worms.

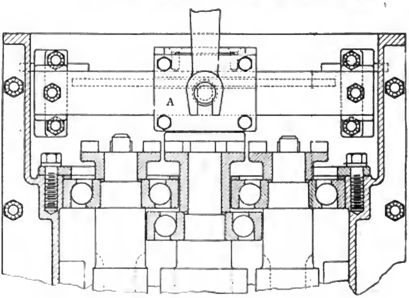
Referring to the cuts which are almost self-explanatory, the upper left shows the layout of the three worms and the triple worm wheel. The lower right view shows the three dog clutches with the propeller shaft in the middle, or high gear position. To change from one gear to another the clutch is thrown out in the usual way, and the action of pressing the clutch pedal also pulls forward the part which slides within the carrier *A*. This disengages the dog clutch and also frees the carrier for transverse movement. The gear lever is then operated, sliding the carrier across till the coupling is opposite either the low speed or the reverse worm, and letting in the clutch then engages the dog clutch before the friction surfaces of the main clutch come together.





Details of Chase multiple worm drive axle as applied to a Willys-Knight four





The small drawing at the center shows how the movable carrier is locked, so that it cannot move sideways while the dog clutch is in mesh. The bar *B*, *B* has three semi-circular grooves in it, and the carrier *A* cannot be moved till the clutch has been withdrawn by fully depressing the pedal.

The gear has been made and applied to an automobile. It is the invention of A. W. Chase, and the patents are held by the Multiple Worm Axle Co., whose offices are with those of the Pan American Munitions Co., Grand Central Terminal, New York.

The experimental model, the drawings for which are used for the accompanying illustrations, has been made carefully, and demonstrates in a satisfactory manner. However, it is obvious that some simplification would be possible in designing for regular production, and both weight and size reduced. At present the weight is said to be a little less than that of the original axle with three speed transmission integral.

The fact that all three worms are running continuously is probably of small importance, since there is practically no load on the worms which are running free. The coefficient of friction between a worm and worm wheel is extremely small, and the amount of power required is negligible.

ACCESSORIES

Binks Racing Carbureter

ONE of the features of this carbureter is that the area past the jet may be varied while at the same time keeping the jet in the most constricted area with a wide-open throttle and combining a true venturi action. The instrument is said to impart strong acceleration, rendering gear shifting much less frequent in hill work and providing maximum speed for straightaway travel. There is a pilot jet for very slow running, and starting the engine when cold is made easy, no flooding being necessary, as with the flap drawn up tight fuel will spray out of the main jet owing to the high velocity past it. Under ordinary conditions starting is accomplished on the pilot jet.

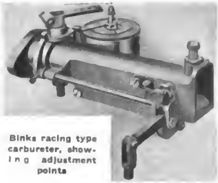
Charles Binks, the inventor, is prepared to sell patents and rights of his carbureters for the United States. Binks carbureters are now manufactured in England in various styles for gasoline, kerosene and heavy fuels for both cars and trucks, prices of the instruments varying with their type and size.—C. Binks, Ltd., Eccles, England.

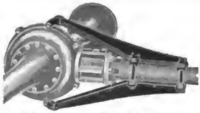
King Valve-Spring Lifter

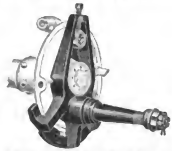
This valve-spring lifter is designed for other than Ford cars. A horizontal member is locked in the valve-cap opening, serving as a purchase for the lever and at the same time holding the valve down from the top. An adjustable chain and ring offer a fulcrum for the notched lever that is caught beneath the valve washer, the washer raised and the locking pin removed. Price, $1.50.—King Specialty Mfg. Co., Brookline, Mass.

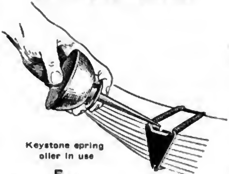
Ekern Emergency Axle

By the use of this device a Ford car with a broken rear axle can be placed on its own wheels and towed home. The emergency axle hooks under the flange on the car-axle housing and is secured by a set-screw at the top. The broken axle stub is then removed from the wheel and the wheel placed on the emergency axle. The axle sells for $5.


Binks racing type carbureter, showing adjustment points


Ekern shaft support for Ford cars


Ekern emergency axle for Fords


Keystone spring oiler in use

Malleable-iron braces are also made for clamping between the end of the drive-shaft tube and the lugs of the differential case, thus supporting the drive-shaft tube of a Ford car. It is stated that the differential housing and the drive-shaft tube are made a unit, thus prolonging the life of the entire rear assembly. The braces may be attached in 10 minutes by any one. Price, $3.50.—Ekern Bros. Mfg. Co., Flandreau, S. D.

Westmoreland Piston Ring

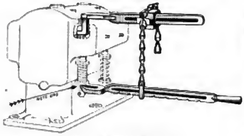
As shown in the illustration, this recently patented piston ring is a two-piece construction, with a lap joint on the outside part and a bevel cut in the inside. The two parts are prevented from moving on each other by the tongue-and-groove feature, while the two joints cannot move around together because of the dowel pin. Some of the advantages claimed are equalized pressure against the cylinder walls, sealed joints, tortuous gas passages, etc. The metal is so distributed as to get equal pressure from each ring. There are no feather edges or excessively thin sections, the inventor stating that there is no chance of wedging between the cylinder walls and the piston and that the ring works equally well either side up.—E. T. Westmoreland, Childress, Tex.

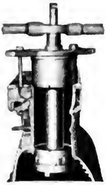
Keystone Spring Oiler

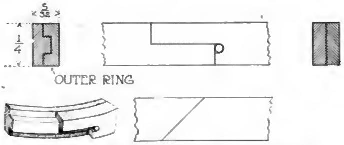
Three coiled springs hold an oil pocket tightly against the sides of the car spring. As the leaves of the spring vibrate with the motion of the car, it is claimed that the lubricant is automatically spread between the leaves. The oiler may be attached to any car, and needs to have the oil supply renewed monthly. Price, 25 cents each.—M. & M. Co., Cleveland.

Storm & O'Hair Reboring Machine

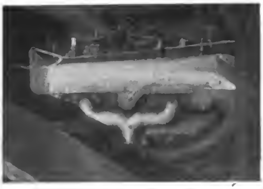
In addition to the standard reboring machine adjustable for all makes of engines this company is now manufacturing a special type for Fords, as illustrated herewith. The cutters are universally adjustable by means of a center cutter adjuster and can be set to cut any desired amount. Each cylinder is rebored and finished to any desired oversize in one operation. The machine is simple and accurate and can be operated by hand, low-speed drill press or other power. Parts are interchangeable with


King valve spring lifter

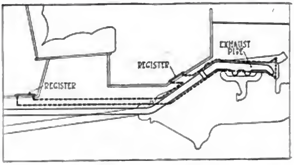

Storm & O'Hair reboring tool



Details of Westmoreland two-piece piston ring construction



At the left is the Ottofy heater attached to an engine, the principle being illustrated in the diagram at the right



those of the standard machine, so additional equipment can be purchased at any time and at moderate cost, to make it suitable for reboring practically all makes of cylinders.—Storm & O'Hair Co., 226 Commercial Street, Thompson, Iowa.

Penfield Spotlight

This small electric spotlight is swiveled on the windshield so as to permit motion in any direction. Two styles are offered, one having a rear view mirror, and the other plain. They are finished in black with polished nickel trimmings. Price, 6-in. light with rear view mirror, $7. Without mirror, $6.50.—Penfield Mfg. Co., Meriden, Conn.

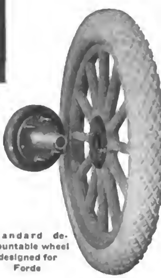
Ottofy Heater

In this device a funnel just behind the radiator catches the air and passes it over the hot exhaust pipes and into the registers in the floor boards. A valve at the mouth of the funnel may be adjusted from the seat, and the desired amount of warm air reaching the registers controlled. Price, large size, touring, $15; roadster, $10; Ford type, touring, $7.50; roadster, $5.—Ottofy Auto Heater Co., 3133 Locust Street, St. Louis, Mo.

Standard Demountable Wheel Set

In converting the regular Ford wheels into demountable and interchangeable wheels, a dummy hub is substituted for the standard Ford hub and carries the wheel by means of four studs and nuts. Flanges are placed on each side of the wheel at the center of the spokes, and are held in place by two bolts. It is claimed that a tire change may be made in 4 min. Price, including a spare wheel, $12. — Standard Auto Accessory Co., Leipsic, Ohio.

Kelley Convertible Truck



Standard demountable wheel designed for Fords

For converting a Ford car into a 1-ton truck. After the removal of the body, rear wheels, rear axle, springs and driveshaft, the attachment is bolted on over the Ford frame. It comprises a special lengthened frame, two heavy semi-elliptic springs and a special rear-axle construction, including brakes, and truck wheels carrying Goodrich 32 by 3½ solid rubber tires. The extended wheelbase is 127 in., giving a loading space of 9 ft. back of the driver's seat. Various styles of bodies for the truck are also made by this company. Price, internal gear, $365; worm gear, $385.—Kelley Convertible Auto-Truck Co., 332 Michigan Avenue, Chicago.

Pontoklene Polish

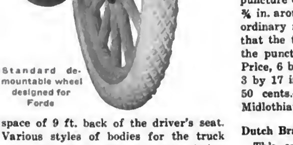
Besides acting as a polish for preserving and improving the car finish with little rubbing, Pontoklene acts as a cleanser, easily removing tar, grease and dirt. The preparation is applied by wiping it over the surface to be cleaned and polished, a little rubbing with a thin, soft cloth sufficing to bring up the gloss. Price, $1.50 per half-gallon can, delivered.—Du Pont Chemical Works, Equitable Building, New York.

Lox-It Patch

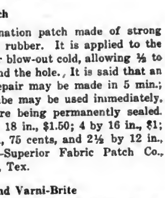
A combination patch made of strong canvas and rubber. It is applied to the puncture or blow-out cold, allowing ½ to ¾ in. around the hole. It is said that an ordinary repair may be made in 5 min.; that the tube may be used immediately, the puncture being permanently sealed. Price, 6 by 18 in., $1.50; 4 by 16 in., $1; 3 by 17 in., 75 cents, and 2½ by 12 in., 50 cents.—Superior Fabric Patch Co., Midlothian, Tex.

Dutch Brand Varni-Brite

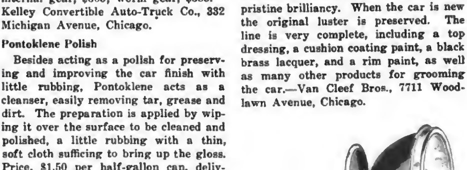
This compound is claimed to restore discolored varnished surfaces to their pristine brilliancy. When the car is new the original luster is preserved. The line is very complete, including a top dressing, a cushion coating paint, a black brass lacquer, and a rim paint, as well as many other products for grooming the car.—Van Cleef Bros., 7711 Woodlawn Avenue, Chicago.



Kelly truck converter applied to a Ford chassis



Penfield spotlight



Kelly truck converter assembly for Fords ready to be attached

Industrial Miscellany

Factory

Robert H. Hassler, Inc., Indianapolis, Ind., manufacturer of automobile accessories, yesterday announced the completion of a modern manufacturing plant on a 6-acre site which will be occupied by the recently incorporated Hassler Motor Co., which has a capitalization of $200,000. The new company, which expects to be in operation shortly after the first of the year, will manufacture a car of medium price, which will be placed on display for the first time at the Chicago show.

American Appliances & Machinery Mfg. Co., Brooklyn, N. Y., will occupy its new building at 161 Jamaica Avenue, on or before Jan. 1.

Fuller & Sons Mfg. Co., Kalamazoo, Mich., will erect a four-story 180 by 60-ft. addition to its plant. This will practically double the plant and increase output by more than 100 per cent.

Oliver Rubber Mfg. Co., Oakland, Cal., is erecting a new building fronting at Broadway and 21st Street, with 10,000 ft. of floor space. The company will enter the tire manufacturing field with a capacity of twenty tires daily. A specialty will be made of large size tires.

J. P. Gordon Co., Columbus, Ohio, maker of fabric goods, has been compelled to put on a night shift of over 200 power sewing-machine operators and will add to this as rapidly as new operators can be secured and trained.

Personals

W. G. Fuller, New Orleans, La., has been made sales manager of the Capital City Auto Co., Studebaker agent.

L. G. Fairbanks has become eastern district manager of the Firestone Tire & Rubber Co., Akron. He was formerly assistant advertising manager of that company. He succeeds D. C. Swander, who goes to Boston as local Firestone manager.

Fred Brandt has joined the staff of the Princess Motor Car Co., Detroit, Mich., as master electrician in charge of the electrical department. Mr. Brandt was formerly electrical expert for the Hupp Motor Car Corp.

G. E. Rason has resigned from his position as advertising manager for the Ford Motor Co., of Canada, and will join Frederick K. Stearns & Co. as assistant manager.

H. L. Walker Co., Detroit, Mich., distributor for the Woods electric in Detroit, will also handle the agency for the Princess Motor Car Corp. for Wayne, Oakland, Monroe, St. Clair, Macomb and Washtenaw counties.

Frank C. Riggs has been appointed general manager of the Pacific Coast territory of the Willys-Overland Co., succeeding A. D. Plughoff, who recently resigned. He has been president of the Oregon Motor Car Co. up to the time of this change.

R. B. Johnston has joined the American Motors Corp., Plainfield, N. J. He will help secretary P. W. Hansl in handling the advertising and assist director of sales I. Brock in his work. He started the automobile column of the New York *Sun*, ran *Leslie's* Motor Bureau for some time and gained valuable merchandising experience while working for Carl H. Page, E. R. Hollander, Harry W. Ford and the Chalmers company.

R. R. Price, formerly distributor of Chalmers cars at Jacksonville, Fla., has joined the tractor manufacturing business with which Carl G. Fisher and C. G. McCutcheon are associated.

A. G. Henderson, of Walla Walla, Wash., has been appointed the Detroiter

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The Automobile Calendar

ASSOCIATIONS

Jan. 6-13—New York, Mid-Winter Meeting of Society of Automobile Engineers, Engineering Society Bldg.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day, Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Jan. 24-26 — Chicago, Second Annual Meeting National Assn. of Automobile Accessory Jobbers. Congress Hotel.

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race. Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13 — Chicago, Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 15-20—Fall River, Mass., Show, Casino.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 23-27 — Oklahoma City, Okla., Show, Auditorium.
Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 25-27—Asheville, N. C., Show, Asheville Automobile Trade Assn.
Jan. 27-Feb. 3—Columbus, O., Show, Memorial Hall, Columbus Dealers' Assn.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 27-Feb. 5 — York, Pa., Show, York Automobile Dealers' Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 28-Feb. 3 — Wilmington, Del., Show, Hotel duPont.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 10-17 — Hartford, Conn., Show, State Armory, First Infantry.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12-17—Bay City, Mich., Show, Armory.
Feb. 12 - 17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 12-19 — Indianapolis, Ind., Show, Steinhart Bldg., Indianapolis Automobile Trade Assn.
Feb. 17-24 — Newark, N. J., Show, First Regiment Armory.
Feb. 19-24 — South Bethlehem, Pa., Show, Coliseum.
Feb. 19-24 — Grand Rapids, Mich., Show, Automobile Business Assn. of Grand Rapids.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 18-25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19 — Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19-24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 24-March 3 — Brooklyn, Show, 23rd Regiment Armory.
Feb. 26-March 3—Omaha, Neb., Show, Auditorium, Omaha Automobile Show Assn.
Feb. 27-March 4—Atlanta, Ga., Show, Auditorium, Atlanta Auto Trades and Accessory Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Auto. Trade.
March 17-22 — New Haven, Conn., Show, Hotel Taft.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.
April—Calumet, Mich., Show, Coliseum, Frank Ketchell, Mgr.

distributor for that section by the Detroiter Motor Car Co.

J. R. Fry, has been made the manager of the Becker Motor Car Co., Grand Rapids, Studebaker distributor. Mr. Fry was formerly in the wholesale department of the Studebaker Corp., Detroit.

Joseph Sairs, Ford dealer at Beloit, Wis., is preparing to establish a plant for the manufacture of brake linings, specializing in such supplies for the Ford. Mr. Sairs has purchased a site and plans to erect a two-story factory, 50 by 160 ft. Work will begin about March 15.

M. L. Helmka has been appointed superintendent of the painting department of the Buick Motor Co., Flint.

R. W. Donohue has been appointed in charge of the sales promotion department of the Regal Motor Car Co., Detroit.

Don M. Dickinson has been made director of sales of the Champion Motors Co., Fulton Ill., and Cleveland.

R. W. Lytle, formerly engineer and production manager of the Bimel Automobile Co., Sidney, Ohio, has been made production manager of the Rock Hill Buggy Co., Rock Hill, S. C.

F. F. Tilden, formerly city salesman at the Indianapolis branch has been installed as manager of the Goodyear branch at Columbus, Ohio, succeeding W. W. Magill, whose duties are to be announced later. W. S. Boone, formerly branch manager at Scranton, Pa., has been made supervisor of city sales at Philadelphia. W. G. Starnes has been made manager of the Atlanta branch, succeeding J. E. Taylor, who has been transferred to the dealer's help division of the automobile tire department at Akron. F. W. Nason, formerly manager of the Rochester, N. Y., branch, has been transferred to the export department at Akron.

J. T. Belanger, Detroit, has become Wayne County agent for the Olympian car, and has formed the Olympian Motor Sales Co.

Joseph Gardham has rejoined the forces of the Chalmers Motor Co., Detroit. He was connected with that company during the days of touring competition, and drove in several trips for the company in pathfinding.

G. F. Hare has joined the Van Cortlandt Vehicle Corp., New York distributor of the Peerless cars and trucks. He has been with the automobile industry for 15 years. For the last 3 years he has been with the Chevrolet company. W. J. Lasher, for the past 4 years district sales manager of the Mitchell Motor Car Co., has also joined the company as district manager.

Hoover Holton has been promoted to zone manager of New England for the Maxwell Motor Co., Detroit.

C. L. Guyman has been promoted to assistant truck sales manager of the Packard Motor Car Co., Detroit. He was formerly in charge of the field representatives.

W. H. Taneyhill has been appointed district manager for the Scripps-Booth Corp., Detroit, succeeding J. E. Morehouse who has been promoted to manager of the local retail store.

W. L. McCabe has been elected secretary and treasurer of the Brewer Motor Car Co., Spokane, Wash. He was formerly office manager of the firm.

Norman DeVaux has been elected general manager of the Chevrolet Co. of Cal., and D. C. Durant has been appointed sales manager of the company. Mr. DeVaux and Mr. Durant were formerly sales manager and assistant sales manager of the company, respectively.

Dealers

Carl M. Green advertising agency has opened an office in Chicago, from which it will handle the advertising account of the Nash Motors Corp. Hal Trump and Owen B. Winter, both former Detroiters, will operate the office.

Not King Factory Branch.—In THE AUTOMOBILE for Dec. 7 it was stated that the King Motor Car Co. had leased premises at 2813 Locust Street, St. Louis, vacated by the Brinkman Motor Car Co., for factory branch. Our correspondent was misinformed, as this is not a factory branch.

Maxwell Motor Co., Inc., will erect an assembly and distributing plant at Minneapolis which will cost $300,000 and will be four stories high and 132 by 330 ft. in size. It is expected that the building will be ready for occupancy and will employ approximately 200 men.

Jennings Motor Sales Corp., New York, has taken the distribution of the Hal.

Fentress Motor Car Co., Seattle, has moved into quarters at the corner of East Pine Street and Tenth Avenue. It will handle the agency for the Peerless.

Adams-Oakland Co., Cleveland, agent for the Oakland and Premier, has leased a two-story building which is to be fitted into a complete automobile sales room and service station. Mr. Adams states that the structure will be occupied by the Ohio Auto Sales Co., which handles the Oakland and Premier cars.

J. Q. Goudie, of Detroit, has been appointed the Michigan agent for the Pennsylvania Rubber Co.

Axel Anderson, president and treasurer of the Union Chain Co., Minneapolis, has bought the interests of F. A. Gahring and will continue adding new machinery and factory improvements to increase the output.

Willys-Overland Co., Minneapolis, has opened the new Northwestern retail sales department and show rooms at Hennepin Avenue and Harmon Place.

Acme Auto Truck Sales Co., Minneapolis, has opened an agency at 917 Hennepin Avenue.

Carlson Motor Car Co., Minneapolis, has opened salesrooms for the KisselKar in a new building at 1626 Harmon Place.

J. F. Lynch, St. Paul, former agent for the Kissel Kar, has been made sales manager for territory east of the Mississippi River.

W. H. Ryan, Wilmington, Del., has taken the agency for Norwalk tires and tubes.

White Brothers, Wilmington, have taken the agency for the International truck.

N. B. Stapleford, Delaware City, Del., has taken the agency for the Grant cars in New Castle County and northern Kent and for the Oldsmobile in the State south of Wilmington.

Consolidated Auto Co., Spokane, Wash., has taken the Eastern Washington agency for the Dixie Flyer cars and the Old Hickory truck.

F. P. Fentress has taken the Seattle, Wash., agency for the Knight tire.

Saunders Motor Car Co., Birmingham, Ala., has severed connection with the Hudson Motor Car Co. and has taken the agency for the Westcott.

Brown & Holland Magneto & General Repairing Co., Little Rock, Ark., has opened for business. In addition to parts for all starting and lighting systems, the company will make good guarantees on Bijur starters and Bosch magnetos.

Cadillac-Stout Co., Memphis, Tenn., has been organized to sell the Cadillac cars. J. A. Stout, formerly of Nashville, is the active partner. Temporary headquarters have been opened at 247 Monroe Avenue.

Independent Tire Co., Columbus, Ohio, has opened a branch at 336 Monroe Avenue, Memphis, Tenn., for the sale of factory seconds. J. E. Leacy, Southern manager, is in charge and will make the branch his headquarters.

Virtue & Liberty Motor Sales, Ltd., Toronto, Ont., has taken on the Ford.

Jubilee Spark Intensifier Co. of Canada, Winnipeg, Man., is handling the Jubilee spark intensifier.

McCurdy-Brainard Company recently established agents in Philadelphia for the Jordan car, has acquired selling rights in this territory for the Maxfer truck.

City Garage, Burlington, Col., Studebaker dealer, has added the Aurora demountable truck agency for Kit Carson County.

Woods-Premier Motor Co., Denver, which recently opened a Premier distributing agency for Colorado and part of Wyoming and New Mexico, has secured the Stewart truck.

V. S. Allen, Longmont, Col., has taken the Aurora demountable truck agency for Boulder County.

Harrison Motor Co., Denver, a new $10,000 corporation, has secured the distributing agency for Colorado for the Liberty and for Northern Colorado and Wyoming for the Jordan, and has opened a salesroom at 222 Sixteenth Street.

Lamar Hardware Co., Lamar, Col., has taken the Aurora truck agency for Prowers and Baca Counties.

Highway Auto Sales Co., Denver, Crow-Elkhart and Argo distributor for Colorado and Wyoming, has gone out of business.

Chandler Agency & Service Co., Greeley, Col., Chandler and Elcar dealer, has added the Aurora demountable truck agency for Weld County.

Colorado Motor Truck & Service Co., Denver, has secured the Service truck for Colorado, Wyoming and New Mexico.

Toliver Punctureproof Tube Co., Denver, has opened a salesroom and shop at 1322 Broadway.

Mid-West Rubber & Auto Co., Denver, Davis distributor for Colorado and part of New Mexico, has moved to 36 East Twelfth Avenue. It has given up the Pennsylvania tire distributing agency for Colorado and will sell cars exclusively.

Merrick Motor Co., Denver, has opened the Crow-Elkhart distributing agency for Colorado and Wyoming.

De Luxe Equipment Co., Denver, has opened a distributing agency for Colorado, Wyoming and New Mexico on the De Luxe body for Ford cars.

Mollman-Mulconnery Motor Co., Denver, has secured the Apperson distributing agency for Colorado, Wyoming and New Mexico.

THE AUTOMOBILE

VOL. XXXV NEW YORK—JULY 6, 1916, TO DECEMBER 28, 1916—CHICAGO NOS. 1 TO 26

Index to Volume XXXV

ACCESSORIES

Abrasives—Wausaw 453
Air Cleaner, Stevens 33
Air Compressor, Compound 824
Air Compressors, Ford Electric 414
Air Valve, Aerofram 196
Air Valve, Duplex 285
Air Valve, Evapco Auxiliary 243
Ambulance, Blackmore Convertible 369
Ames-ton Truck for Fords 196
Angle Plate, Universal 903
Anti-rattler, King 945
Apco Ford Specialties 904
Autopower Attachment 332
Auto Specialties Gets Overland Contract 916
Axle, Ekeran Emergency 1115
Axle, Peru 2600-lb., with Malleable Housing 491
Axle Truss, Hoyt 627
Battery Ignition, Philbrin 584
Battery Charger, Ft. Wayne 452
Bearing, Hercules Auxiliary 678
Belt Coupling, Toscot 903
Bench, Manley Portable 331
Body, Amesbelt Cloverleaf, for Fords 1014
Body, Remo, Ford Racing 244
Bolt, Landau-Farr Lubricating 357
Brake, Prest-O-Lite 774
Breather Pipe, Apco Ford 583
Brakes, Morton Front Wheel 499
Brake, Water, Hershell-Spillman 1011
Bumper, Badger Spring 824
C. & E. Specialties for Fords 244
Caliper, Bowden Wheel 284
Carbon Remover, Johnson 582
Carbureter, Ball & Ball 243
Carbureter, Binks Racing 1115
Carbureter, Gardner Thermostat 627
Carbureter, Eynon 401
Carbureter Heater, Line 903
Champion Delivery Chassis, New 916
Charging Outfit, Westinghouse 368
Chevrolet 6,000 Cars Behind Orders 916
Clutch Control, N. Y. 723
Church Fuel Feed 668
Cleaner and Primer, MacDonald 195
Constolite for Fords 722
Converter, for Ford, Franklin 583
Connecting Rod, Ryerson 32
Corning Conophore 863
Cotter-pin Puller, May's 284
Creeper, Mecco 723
Curtain Light, Instant Back 369
Cut-out, Petry 332
Cylinder Reboring Tool 369
Decarbonizer, Wegman Automatic 499
Dig-U-Out 904
Dimmer, Dazzle 75
Dimmer, O-U-Lite 33
Disco Branch Chain 916
Doors for Garages, Fold-up 244
Duster, Protexall 74
Enamel, Effecto 414
Engine Warmer, Hughes Electric 988
Extension for Fords, H-D 627
Fillometer for Fords 987
Forbes Extension for Fords 331
Fuel Feed, Church 668
Gage for Fords, Badger 195
Gage, J-A-Y Vacuum 74
Garage Bench 74
Gasoline Lock, Turner 368
Gasoline Saver, Right 158
Gasoline Saver, York 678
Gillam Increases Capital to $800,000 916
Glove, Allen 863
Graphite Lubricator 284
Gray & Davis Electric System for Fords 232
Grease Gun, Lewis Pneumatic 582
Hand-I-Wash 32
Hassler Motor Co. Formed 916
Headlight Dimmer, Nodez 988
Headlight Lens, Legalite 158
Headlight Lens, Primolite 945
Headlight Regulator, Waynelight 823
Heater, Bailey Muffler and 988
Heater, Garage, Wasco 453
Heater, Ottofy 1116
Heat-Ometer 498
Hood Holder, Ventilating 499
Hose-air, Resistol 453
Hub, Detachable Aeroplane Propeller 897
Humidifier, Vapo 332
Hydrovaporizer 945
Icy-Hot Motor Restaurant 369
Ignition Lock, Thiefoil 723
Jack-Hi-Lo 453
Jack, Rotary 823
Jack, Trump 582
Jack and Pump, Brisk Blast 75
Jack and Tire Lock, Weed 244
Jack, U. S. 368
Kemco Starter Under Hood 916
Lamp Assortment, Edison 824
Lamp, Comet Dash and Trouble 499
Lamp Lights Tire, Side Shaw 448
Lamp, Superior Spot 678
Letter-Pack-It 196
Lighting System, Genolite 864
Lighting System, Van Sicklen 1069
Lock, Adams Spark and Throttle 33
Lock, Bo-Hart Switch 452
Lock for Fords, Rex 32
Lock for Ford, Warner 863
Lock, L-G Auto 74
Lock, Perry Steering Wheel 987
Lock Switch, Goodrich 723
Lock, Utility Luggage 824
Lubricator, Monitor 904
Magneto, K-W 284
Magneto, Simplex 149
Millington Converter Makes 2-Ton G. M. C.
  Into 4-Wheel Drive 895
Mud Cover for Fords 332
Myle-Maker for Fords 863
National Mix-O-Lock 33
New Era Factory Adds 916
Oxy-Acetylene Outfit, Searchlight 196
Patch-It Patch 1116
Patch, Rub-R-Tite 627
Patch, Woods Everloc 74
Perrin No-Glare 33
Philbrin Battery Ignition 584
Pillsbury Hubpul 823
Pilot, Miller Safety 74
Piston, Ford, Luvium Metal 74
Pistons for Fords—Featherweight 452
Piston Ring, Chopa 823
Piston Rings—Hi-Comp 498
Piston Ring, Economy 331
Piston, Semi-Steel 723
Piston Ring, No-Leak-O 988
Piston Ring, Stevens Non-Set 987
Piston Ring, Union 626
Piston Ring, Westmoreland 1115
Polish, Pontoklene 1116
Polish, S-O-S 75
Polish, Superlustre 414
Polson's Hook-On Boot 285
Post Type Evenlite 158
Primer, McCormick, Electrically Operated 579
Primer and Cup, Ideal 75
Primer, Ideal Pressure 987
Pump, Hull Self-Service 243
Pump—Twombly Foot 452
Puncture Plugger, Bale's 74
Push Switch, Spotlight 824
Radiator Cover, Campbell 863
Radiator Damper, Hudson 945
Rain Shield, U-Can-C 582
Reboring Machine, Storm & O'Hair 1115
Repair Gears and Parts 158
Rheostats, Cutler-Hammer 195
Rim Contractor, M. & C. 678
Rim Tool, K. P. Universal 158
Robe, Name-On 678
Robe Rail, Ideal 945
Searchlight, Howe 331
Shingles—M & E Metal 498
Shoe, Anti-Skid 582
Shock Absorber, Adco 75
Shock Absorber, Cantilever 158
Light, Glare-Off 583
Signalite, Automatic 32
Signal, Handy 946
Signal, Kennedy 722
Signal, Lexington Safety 626
Signal, National Safety 946
Signal, Nokloyd Electric 75
Signal, Universal Night 369
Snubbers for Ford, Paramount 863
Soldering Paste, Burnley 75
Soldering, Wall Handle for, Stewart & Co. 33
Spark Intensifier, Des Moines 74
Spark Intensifier, Marvel 987
Spark Advance, Automatic 583
Spark Plug, La French 946
Spark Plug, Oxy-Ignitor 583
Spark Plug, Fan-Fire 414
Spark Plug, P. D. Q. 864
Speedometer, Johns-Manville, Six 1062
Speedometer, Standard Thermometer 321
Spotlight, Amco 196
Spotlight, Nitro-Jector 946
Spotlight, Penfield 1116
Spring Check, Twin Safety 33
Springs, Duplex Cantilever 498
Spring Leaf Lubricator, Apco 332
Spring Lubricator, Major's 414
Spring, Lyon Self-Lubricating 626
Spring Oiler, Babbitt 369
Spring Oiler, Keystone 1115
Spring, Stanley Self-Lubricating 722
Stands and Cranes, United 498
Starter, A-B-C 412
Starter, Shur-Go 195
Steer—Adins for Fords 369
Steering Gear for Fords 946
Steering Gear, Moore 903
Switch, Connecticut Dimming 946
Switch, Hartman 331
Tap—New Greenfield 498
Tar Remover 626
Thermo Vacuum Fuel Feed 285
Timer, Dean Knife for Fords 903
Time-Stamp, Cosmo 453
Timer for Fords, Bemus 452
Tire, Amazon 864
Tire, Big 4 823
Tire Chain for Trucks, Herman 863
Tire, Pennsylvania Bar Circle 903
Tire Pump, Rex 626
Tire, Sebring 582
Tire—Goodyear Fire Truck 452
Tire Holder, Badger 332
Tire Patch, Permatite 369
Tire Pump, Crane Power 195
Tire Rack Brackets, Elgin 414
Tire Retread Kit, Star 904
Tire Tool, Schultze 158
Tool, Storm & O'Hair Reboring 32

Top Covering, S. & H. 285
Top for Ford, Anchor 332
Torch, Searchlight 903
Towing Pole, Weaver 627
Towing Truck, E. & S. 824
Tractor Attachment, Megow 887
Tractor Attachment, Traeford 722
Trailer, Delker 75
Trailers, Nonpareil 284
Transmission Flanges, Premo 722
Truckford Attachment 723
Tructor for Fords 285
Tread Mill—Lally Motor 498
Truck, Kelley Convertible 1116
Tubes—Armstrong Inner 498
Valve Grinder, Nasco 988
Valve Packing, Apco 368
Valve Spring Lifter, King 1115
Valve Stem Reamer, Stevens 864
Varni-Brite, Dutch Brand 1116
Vise, Fulton Machinists' 823
Vulcanizer, Anderson Steam 722
Vulcanizer, Shaler Tube 904
Wash Lamp Stand, Muller 32
Wash-Stand Floor Trap 368
Watch, Voss Auto 196
Water Circulator, Perfection 243
Westinghouse Noiseless Bakelite Gears 1005
Wheel, Baker Steel, Has Tension Spokes 1018
Wheel, Blakoe Steel 219
Wheel, Demountable Set, Standard 1116
Wheel, Disk, Detroit Pressed Steel 615
Wheel-Puller, Fords 453
Wheel, J. B. D. Resilient 195
Wiring for Fords, Fan 331
Wrench, Eagle Claw 368
Wrench, Keystone 284
Wrench, Universal Master 864
Wrench, Walden Double Offset 988

ASSOCIATIONS AND CLUBS

A. A. A. Contest Board in Session 550
A. S. A. E. Members Can Join S. A. E. 501
Battery Service Discussed by Ind. Service Mgrs. 1001
Hardware Assn. Accessory Branch 692
Illinois Automobile Trade Assn. Now 692
M. & A. M. Members, Three More 471
M. & A. M. Adds 6 Members 834
M. & A. M. to Confer on Aeronautics 996
N. A. A. J. Remedies Trade Evils 632
N. A. C. C. Forms Traffic Board 512
N. A. C. C. Committee Named 512
N. A. C. C. at Christmas Cove 126
New York Organizations to Amalgamate 81
National Gas Engine Assn. Members Advocate Affiliation with S. A. E. 4
Safety First Advocates Education 1000

SOCIETY OF AUTOMOBILE ENGINEERS

Assets Are $33,000 687
Brush Analyzes Crankshaft Balance at Indianapolis 877
Buffalo Section Formed 994
Carburetion at Ind. Section 1036
Cleveland, Doble Talks on Steam 686
Detroit Sec. Discusses Fishleigh's Paper 656
Head-Lamp 42-in. Law Indorsed 997
Ideal Truck to Be Specified 572
Lamp Standards Progressing 342
N. Y. to Discuss Aluminum 643
Papers for Winter Meeting 830
Review of 1916 1093
Show Week Session 342
Standards Com. Accepts 4 Standards Reports 644
Standards Committee Enlarged 1036
Truck Div. Standards Committee Meets 912
Washington Meeting 86
Truck and Tractor Engines, Paper by Horning 388
Truck Lever Controls Standardized 257
Kettering Talk on Temperature 457
S. A. E. Membership for Aero Men 457
S. A. E. Testing System Proved 912
Tractor Men Debate S. A. E. Merger 288
Trailer Makers Form Association 599
Watson Heads Pennsylvania S. A. E. 735
Wisconsin Roads Assn. Plans Fuel Test 836

CAR DESCRIPTIONS

Aland 4 178
American Six 1053
Anderson 5-Pass. Roadster 276
Briscoe 4 175
Brown 148
Buick 4 92
Cadillac 55 for 1917 239
Chandler Models, Two New Convertible 537
Cole-Springfield Body 62
Detroit Electric 1012
Dixie 358
Doble Steam Car 410
Elgin 1060
Empire 6 Tourabout Body 365
Enger 12 391
Franklin 136
Glide Roomier and More Powerful 486
Hackett Body Is of Striking Design 356
Hal 12 230
Harroun 230
Haynes Light 12 181
Haynes Roadster for 4-Pas. 355
Hollier Six and Eight 274
Homer-Laughlin Light Eight 442
Inter-State Features Bodies 438
Jackson 8 398
Jackson I-Head 8 355
Jeffery 4 12
Jeffery Six 223
Jordan 98
Kent 1059
King 4-Pas. Model 1066
Lexington 612
Liberty Production on Quality Basis 494
Madison 144
Maibohm Roadster 578
Majestic 1107
Marion-Handley in Two Models 95
Maxwell Elite Model 536
Mitchell Chassis, Smart Four-Season Bodies For 443
Moline, 1917 664
Monroe Touring Car 900
Monroe 146
Murray 8 1015
National 12 140
Nelson 1109
Oakland 704
Oldsmobile 8 1104
Olympian 1055
Overland, 1917 Models 51
Packard, 1917 272
Paige, 1917 54
Paterson Models for 1917, Two New 440
Premier, Aluminum Engine in New 361
Princess, 1917 860
Ross 8 for 1917 9
Saxons Improved in Design 534
Singer, Aluminum Alloy Pistons In 483
Studebaker 4 and 6 974
Stutz 16-Valve Roadster 360
Stutz, 1917 229
Sun Adds 4-Pass. Roadster 533
Velie 235
Westcott Adds Springfield Touring-Sedan Body 445
Westcott Cloverleaf Roadster 902
White 4 Has 16 Valves 950
Willys-Knight 221
Willys Six 327
Woods Dual Power Car 364
Yale Eight in Production 488

COMMERCIAL VEHICLES

Bourne Truck Has Magnetic Transmission 713
Burford Truck in 2 and 4-Ton Models 489
Canadian Truck Simple in Production and Operation 940
Collier Light Truck 622
Day-Elder, 2-Worm-Drive 57
Denmo 1000-Lb. Truck 625
Directory of Truck Makers 751
F. W. D. Repair Truck for U. S. Army 63
F. W. D. Truck Hauls 26-Ton Load, 3-Tonner 577
German Truck Design Is Improved 850
Jeffery Quads with Wrecking Equipment for Mexico 59
Mack Armored Truck in N. Y.-Plattsburg Run 416
Maxwell 1-Ton Truck 1068
Mexico, Trucks Aid Army 11
Mexico, U. S. Trucks In 402
Military Truck a Complicated Problem 750
Moreland Touring Yacht 852
Ranier Delivery Car 320
Red Cross Jeffery Truck for N. Y. Militia 400
Republic 1500-Lb. Truck 714
Thomas Cab Protects Driver 407
Thomas Truck 47
Tractor, British Favor Gasoline 749
Truck Design, Few Changes In 746
Truck's Emancipation 739
Trucks Transport 2000 Troops 462
Watson Tractor for Contractors 23

CONTESTS

A. A. A. Disqualifies Two Makers 736
American Speedways Assn. Formed 832
Ascot, Rickenbacher Wins At 959
Astor Cup Race, 36 Entries For 550
Astor Cup Will Be 250 Miles 461
Astor Cup, 22 Entries 506
Cadillac Breaks Record Across Iowa 650
Chicago, Amateur Races For 832
Chicago, Resta Wins 250-Mile Grand American 653
Chicago, Resta Wins Grand Prize 310
Cincinnati, Aiken Wins 418
Cincinnati 500-Mile Race 1043
Columbus Has Speedway Company 293
Denver Speedway Costs $100,000 416
De Palma Gets 50-Mile Record 691
Elgin Race Postponed 123
Ford Races Draw 10,000 426
Giant's Despair Hillclimb 416
Giant's Despair Won by Chalmers 636
Grand Prize, Aitken Wins 873
Grand Rapids, Ogren Wins at 82
Hollier Wins Wager Race 636
Hoosier 500-Mile, May Revive 506
Hudson Coast to Coast Record 420
Hudson, Another Record For 513
Indianapolis Race, Aitken Makes Clean Sweep 463
Kalamazoo, Two Killed at 377
Kansas City, De Palma Wins at 165
Kansas City Speedway Nears Completion 43
King Covers 10,850 Miles in 2 Weeks [illegible]
King Economy Test Over the Road 309
King 8 Makes Providence-Detroit Run on High Gear 72
King Finishes High-Gear Run 247
King Making 2-Week Run 335
Los Angeles-Salt Lake Race Planned 164
Marmon Car, A. C. A. Seals On 289
Marmon Coast-to-Coast Record 168
Marmon Seals Broken Due to Road Contact 335
Master Carbureter Co. Holds National Economy Test 335
Master Driver Run Halted 691
Maxwell Issues Open Challenge 737
Maxwell Makes Speed Test Run 837
Miniature Racing Cars Make 70 m.p.h. 672
Minneapolis Speedway Suspended 165
Myle-Mayker Gives 26.6 m.p.g. on Ford in A. A. A. Test 650
Newark, Stutz Wins at 42
New York, Aitken Wins Harkness Trophy Race 772
Oldsmobile Crosses Continent in 11.23 Days 335
Omaha, Resta Wins 122
Packard 12 Breaks Track Record 247
Paige-Detroit Roadster on Transcontinental Run 383
Pathfinder High Gear Run Ends 206
Pathfinder Starts High-Gear Run 5
Phoenix-Douglas Race Won by Paige 837
Phoenix, Stutz Wins at 877
Pike's Peak, Hudson and Chalmers Win at 292
Pittsburgh Speedway Buys Land 550
Phoenix, Stutz Wins at 958
Racing Cars, Drivers to Build 912
Resta Champion 958
Ross Climbs Record Hill 691
San Diego-Los Angeles Truck Run 164
Saxons, 52 on 3000-Mile Relay 118
Saxon Relay Breaks Record 165
Saxon 6 Averages 34⅜ m.p.g. 78
Sheepshead, Astor Cup, Aitken Wins at 104.83 562
Shields, Anderson's Mechanic, Dies 636
Sioux City Race Postponed 43
Sioux City, Wilcox Wins at 82
Speedways Ban Sunday Races 593
Tacoma Races Marred by Accidents 164
Tacoma Races Postponed 43
Tacoma, Rickenbacher Wins in 247
Twin City 150-Mile Race, De Palma Wins 1
Twin City Speedway, Double Assessment for 696
Twin City Speedway Receiver 377
Twin City Track, Receiver for 81
Uniontown Speedway, 2 Killed at 912
Uniontown, Frontenac Wins at 958
Uniontown, 2 Races for 691
Vanderbilt Won by Resta 872

EDITORIALS

Advertising, Convincing 838
Aero Caution 694
Assembly, Progressive 694
Automobile Securities 547
Battery Care 545
Bed Rock 918
Better Cars 1044
Better Work Wanted 38
Body Fashions 628
British Tax Lifted 26
Broadening the Base of the Sales 286
Building vs. Assembling 500
Carbureter Demands 1002
Caterpillar Tractors 197
City Exits 1002
Clutches and Winter 838
Credit Where Due 236
Detachable Heads 796
Engine Development 796
Exports Highest Yet 197
Farm Tractor Opportunity 159
Federal Gasoline Report 333
Few New Multis 26
Financing Stronger 333
Ford 197
Ford Race, The 454
Ford Service 333
Fuel Common Sense 38
Gear Ratios 286
Generator Reliablty 918
Glare Problem 628
Ignition 960
International Competition 878
Kerosene Nearly Arrived 415
Legal Confusion 960
Materials Steady 26
Mathematical Cycles 370
Newby, A. C. 1002
Obtaining Ideals 587
Our Foreign Trade 245
Overdoing Accessories 454
Parking Problem 1044
Power Breaking 738
Prices Up 694
Production 116
Racing Mismanaged 587
Recognition 116
Selling as a Science 116
Small Spark Plugs 454
South American Trade 159
South American Trade 245

Spotlight 652
Standards, More 652
Stop 545
Tanks 500
Taxicab Design 652
Temperature Control 415
Tires 587
Tires, Year in 878
Tonneau Windshields 76
Tractor Trial Wanted 370
Tractor, Develop the 545
Tractor Engine 796
Truck Progress 738
U. S. Troop Trucks 500
Widening the Industry 415

LEGAL AND LEGISLATIVE

Accessory Makers Bankrupt, 2 Detroit 630
Accidents, 70 Per Cent at Cross Roads 954
Baltimore, New Parking Law for 790
Cadillac Starts Suit 955
Chapman vs. Peerless, Plaintiff Wins $412,812 876
Deferred Payment Difficulty 56
Dile Motor Co. Petitioned 375
Dimmers in Phoenix 637
Disher Bumper Patent Valid 687
Eclipse Entitled to Bijur License 86
Far Side Stop for Buses 82
Faw Suit Dismissed 126
Good Roads, $170,000,000 for 72
Headlight Device Investigated by Judge 334
Inter-State Sues Rutenber 877
Kentucky Revivo Battery Petitions 203
Krit, $13,000 Assets 163
Lancaster Can Use Midgley 248
Laws, Uniform for Pennsylvania, New Jersey, Maryland and Delaware 1039
Lewis, Capt., Pays L. P. C. Debts 337
Livingston Receives Perpetual Injunction 1037
Livingston Shell-and-Hood Patent Upheld 877
Locomobile Lamps Do Not Infringe 372
Mail Driver Must Obey the Law 632
McClurg Tire Receiver 337
McClurg to Reorganize 375
Moto-Meter Enjoins Heat-Ometer 954
New Jersey's Bad Truck Measures 646
New York Traffic Violations Decrease 382
Ohio Speed-Trap Industry Hit 416
Peerless Asks New Trial 1038
Pennsylvania Fees for Good Roads 790
Prest-O-Lite Gets Injunction 646
Prest-O-Lite Injunction Against Power City Sun-Lite Gas Co. 687
Repair Men, to License 1039
Springfield Body vs. Fisher Body 876
Traffic Laws to Be Clear 836
Traffic Plan for New York 594
Truck Converter Contract in Dispute 735
Truck Fees, Want Higher 913
Twin City Speedway, 2 Receivers for 637
Underspeeding Brings 2 Months' Sentence 637
Wheel, Dealer Looses Suit 655
Wisconsin Municipal Cars Need License 296

MISCELLANEOUS

Advertising, More News Is Wanted 815
Aeroplane Engine Design, Effect of War On 431
Allen All-Weather Bodies 721
Armored Car Raids Audacious 576
Armored Cars for U. S. Warships 50
Australian Imports Increase 200 Per Cent in First 6 Months of 1916 776
Australian Industries Are Prosperous 198
Austria-Hungary 1045
Belgians Develop New Armored Cars 708
Body Design Permits Swinging Front Seat 277
Brazil—Part 1 514
British Idea of Inexpensive Car Vastly Different from American 306
Bulbs, Carrying Spare 232
Cadillac Welfare Dept 350
Childs, Body Design Roomy 529
Cleveland, Rising City in Industry 542
Clover-Leaf Runabout Design 62
Continental Assembly Is Progressive 669
Daniels 8, 2 New Models 1011
Denmark, a Good Car Market 925
Dodge Convertible Sedan 981
Dolly Madison 4-Pas. Roadster 983
Door Mat for a Town Car 347
Efficiency vs. Neatness 179
Electrics Cheaper Than Horses in Garbage Haulage 445
Exports, May, $10,853,134 46
Exports, June and Fiscal Year 169
Exports, 6501 Vehicles in July 458
Exports, August, $10,068,538 557
October, $9,341,119 951
Exports, October 906
Exports, September, $10,117,808 729
Exports, War, Total $120,000,860 599
Female Labor, Should Use More 816
Fiat Armored Trucks in Battle Service 814
Finish, Conferring Life Through Core of 316
Ford Racers Were Built—How 465
Ford's Melting Pot 611
Four-Wheel Drive for Heavy Tractors 311
French Army School Trains Drivers 226
German Industry, War Develops 812
Germany After the War 1003
Grant Winter Bodies 717
Hillick on Finish of Body 316
Hudson Garage in New York City 715
Hurley on Successful Business and the Trade Press 893
Invention Needed on Tonneau Carpet Slots 318
Jackson's 2000-hp. Crash at 100 m.p.h 986
Jeffery Sedans 862
Jordan Limousine 1047
Kissel All-Year Town-Victoria Body 319
Labor, Reducing Waste 1058
Mastodon Tractor Ready 437
Mitchell Boat Body 183
Mitchell Special 5-Passenger Design 59
Mojave Desert to Be Marked 632
Moon Closed Models 928
Moon Coupé and Convertible Sedan 892
National Factory Hospital 577
New South Wales Imports Increase 138 Per Cent 614
Nuts Inaccessible 277
Oldsmobile 8 Cabriolet 924
Overland's New Toledo Building 660
Owen-Magnetic in Coupé Form 719
Paint Poles White at Danger Points 615
Perfection Spring Co., Committees Manage 819
Perlman's Jackson Plant Grows Fast 449
Platform, Car Unloading 973
Radiator Cap Fittings 99
Reo Welfare Committee 1007
Republic Rubber Protects Workers 888
Review of 1916 1087
Roads Are Bituminous, 15.4 Per Cent of New York, New Jersey and Pennsylvania 494
Roamer, Custom-Built Bodies on 222
Russia, Awakening of 568
Salesmanship, Quotas and Their Use in 200
Scripps-Booth Coupé on 4 712
Scripps Detachable Winter Top 944
South America, Accessories in 302, 428, 472
South America 128
Studebaker Custom Bodies 670
Studebaker Dealers in S. A. Meet in Buenos Aires 1051
Swiss Exports Valued at $5,790,000 in 1915 337
Switzerland, Automobile and Truck Industry in 937
Switch, Paige 662
Tanks, a British Account 621
Tire, Concealing Spare 357
Tire Fillers Sections, Overlapping 271
Tire Industry 879
Uruguay 695
U. S. A. Cars Most Popular in British South Africa 455
United States Has 2,932,455 Cars 262
Venezuela Wants U. S. A. Cars 429
Welfare Department at Cadillac Plant 350
Westinghouse Club of Practical Value 942

REGISTRATIONS

Alabama, 23,033 687
Alberta, 7800 376
California, 189,610 in 58 Counties in 6 Months 570
Canada, 120,000 Cars in 790
Colorado to Have 45,000 Cars 490
Connecticut Gain 33 Per Cent 637
Georgia, 42,000 376
Iowa, 190,000 687
Iowa Has 400,000 Cars 506
Kansas, 129 Makes of Trucks in 177
Maine, 23,000 420
Massachusetts, 125,524 633
Massachusetts, Gain 31,000 790
Massachusetts, 105,488, Analyzed 201
Missouri, 180,000 420
New Hampshire, 16,000 420
New York, 303,223 687
New York City 6 Months' Fees, $1,100,203 376
Ohio, 232,017 376
Ohio, 254,000 912
Ontario and Other States of Canada 912
Rhode Island Analyzed 266
Texas, 150,000 392
United States Has 2,932,455 Cars 263
Wisconsin, 115,000 687
Wisconsin, 110,350 420

ROSTRUM

Adjustable Pedals on Many Cars 540
Air Starter Installation 72
Allis-Chalmers Wiring and Connections 541
Ammeter Probably in Damaged Condition 450
Ammeter Not Advisable on Cole 4-40 366
Ammeter on 1913 Cole 279
Ammeter on 1916 Hupp 323
Armature Testing for Short Circuit 111
Axle Shafts Breaking —
Autocar Elects Officers 909
Avoid Stopping on Main Highway 985
Battery Ignition Diagram 1073
Battery Installation for Headlights on Ford 367
Bijur Regulator Wiring Diagram 677
Buick 25 Ratio, Cannot Change 366
Bulbs on Dodge Are Standard 31
Buick D 45 Knocks Below 8 m.p.h. 450
Buick Air Pipe Now Shorter 540
Buick Wheel Locks 1073
Bulbs, Nitrogen Filled 677
Cadillac 1914 Wiring Diagram 190
Carbureter, Climatic Conditions 623
Claudel Carbureter 1072
Chalmers 1912, Aluminum Pistons Would not Give Material Gain 278
Click on New Engine 322
Compression of Racing Cars 580
Compression Bad on 3 Cylinders 496
Combustion Time 1073
Connecting-rod Bearings Not Right 408
Crankshafts on Ford Broken 408
Crankshaft Speed and Engine Efficiency 190
Cylinders on Mercedes Aviation Motor 1073
Delco Ignition System Operation 986
Diesel Engine Information 30
Differential and Transmission Assembly 581
Differential Gear Ratio 676
Door Spring as Aid in Assembling 821
Dynamometer Power, No Formula for 581
Dyneto Ford Data 110
Eight Cylinders Placed in Line 366
Engine May Be Loose in Frame 451
Engine Needs Overhauling, Reo 676
Engine Operation of Automobile 30
Engine, 16-Valve 4's, Why They Are Made 278
Entz-Chalmers Wiring Diagram 409
Final Drive Efficiency 366
Ford Accepts Only Unemployed 623
Ford, Speeding Up a 1908 624
Formula Rating of Ford Is 22.5 hp 540
Ford Car as a Racer 367
F. R. P. Chassis Suitable for Racing 540
Frame, Underslung Design Liked 110
Gasoline, Conditions Due to Low-Test 150
Graphite as Lubrication End 31
Haynes Rebuilt for Speed 367
Herreshoff 1910 Multiple-Disk Clutch 986
High-Speed Engine Definition 624
Horsepower and Pulling Power 541
Horsepower Taxes 721
Horsepower Tests Information 110
Howling in Axle of 1916 Car 408
Hudson 33 Into Delivery Car 676
Hudson 54, Installing Ammeter on 451
Hudson Super-Six Data 580
Hudson 1912 Starter Installation 111
Hupmobile 20, Correct Timing for 450
Hydrogen Flame in Burning 1073
Jack Bracket as Standard Axle Fitting 241
Knock Caused by Overheating 623
Knock in Oldham Coupling 623
Levett Pistons Made in N. Y. 242
Lubrication, Studebaker, Is Provided on Grades 676
Magneto Spark Delivery, Order of 30
McLaughlin-Buick 1914 Information 191
Mean Effective Pressure, Data on 821
Mercedes 1905, Retiming 322
Mercer Full Retard on Top Center Position 451
Metals, Data on Expansion of 540
Mets Railroad Wheel 1072
Michigan Radiator, Redesigning 496
Miller Car Not Built at Present 409
Naphthalene Not Recommended 496
National, Changing to Racing Car 323
Needle Valve Probably Misadjusted 323
North East Unit, Charging a 1911 110
Oiling System of 1911 Pope-Hartford 150
Oil Satisfactory in Ford Cups 677
Olds 1907 Loses Power on High 366
Omaha Race, Had to Make 75 m.p.h 450
Overheating Causes Knock on Hill 623
Overland 69 Oiling, Changing Inadvisable 581
Overland Uses Continental Engine 676
Packard 12 Gear Ratio 580
Packard Uses Double Distributer 367
Pai[illegible] Diameter of Exhaust Pipe 1072
Pai[illegible] Oiling the Clutch on 1917 —
Paint Dull Under Varnish 409
Peerless, Has 1905 Overhead Valve 985
Pistons Are Larger 496
Plates Worn, Clutch Out of Alignment 278
Power Delivered Through Outside Wheel 540
Power and Speed, Wants Higher 242
Power Loss, Mistimed Spark Causes 151
Races Run Counter-Clockwise 150
Radiator Cleaning 1072
Removing Scale From Radiator 541
Regal Built Into Runabout 190
Remy System Circuits on Madison 241
Reo, 1915, Differential Adjustment 30
Rims, Heavier Wedges Will Secure Baker 242
Schebler Model H Carbureter, Adjusting 241
Scripps-Booth 1917 Cars Now Out 409
Six-Cylinder Firing Order 408
Spark Plug Testing 151
Speedometer, Route Indicator to 677
Speedometers Should Be Easy to Read 322
Sporting Phaeton 720
Springs, Believes in Full Elliptic 497
Stationary Power Plant Engine 409
Steamer to Gas Car 985
Stearns-Knight Engine, Information on 497
Tar From Car Bodies, Removing 985
Tar Remover, Linseed Oil as 721
Tar, Removing From Car Body 581
Temperature Best, 170 to 180 deg 721
Timing for '17 Buick 985
Tires Marked on Outside 409
Toeing in Front Wheels 540
U. S. L., Diagram Showing Voltage in 451
Valve Stems, Preventing From Sticking 580
Valve-Grinding Should Be Uniform 23
Velie, Revamping a 1910 581
Wagner system Wiring Diagram 821
Warren-Detroit Won't Take Hills on High 624
Wheels, Wire, Two Spare 540
Wire Wheels, 55,000 in 1916 677
Wiring Diagram of Maxwell 25 624
Wiring Diagram of 1910 Pierce 48 985

Wiring for 2-Battery Circuit........ 151
Wiring of 1913 Hudson........ 73

SHOWS

Accessory Exhibits, 127 New........ 789
Accessory Exhibitors, Three More........ 917
Accessory Space Allotted........ 642
Atlanta Show a Success........ 693
Boston to Have Salon........ 1000
Brockton, Car Show Building at........ 507
Brockton Outdoor Show........ 637
Chicago Used-Car Show........ 599
Iowa Fair, 30,000 Autos at........ —
Los Angeles, 94 Car Exhibitors at........ 737
Lyons Fair Despite War........ 681
Milwaukee Show, 84,000 See........ 507
N. A. C. C.'s New Dealers' Arrangement for National Shows........ 917
New York Electrical Show Opens........ 651
Salon, 17 Exhibitors for........ 959
Show Spaces Allotted........ 604

TECHNICAL

Aeroplanes for Sport and Utility........ 27
Air Bag Precautions........ 57
Alcohol, the Fuel of the Future........ 932
Aluminum Engines in France........ 15
Aluminum, Extending Field, Diamond's S. A. E. Paper........ 711
Aluminum Piston, Secret of Success........ 317
Aluminum Scrap Melting, Difficult........ 1016
Automobile Nomenclature........ 34
Axle, Allen Clutch Drive........ 980
Axle, Chase Multiple Worm Drive........ 1114
Axle, Empire, Has No Differential........ 822
Axle, Otis, for 3½ and 5-Ton Trucks........ 1061
Axle, Peru Rear in Two Styles........ 107
Axle, Timken 5-Ton Worm-Driven Truck........ 31
Balance, Should Study Car........ 984
Brake Design, by Younger........ 929
Ball-Bearing Experience........ 413
Brake Design Not Up to Par........ 524
Brake, Vacuum, Prest-O-Lite........ 774
Bushings, Self-oiling........ 1017
Carbonization of Oils Due to Oxidation........ 283
Carbureter Changes........ 1022
Carbureter, Eynon........ 401
Clutch Inserts, Adjustable, Devised by Slade........ 396
Clutch Design........ 848
Constant Pressure Efficiency 25% Lower........ 352
Conveyor System Aids Big Production........ 100
Cycle, Constant Pressure, Truly Efficient........ 935
Cylinders, Securing Even Power in, by Antony........ 267
Differential, Miller Has New Motion........ 68
Distributer, Pittsfield, Make and Break Positive........ 180
Drawbar Pull, Torque and Ratio Determine........ 349
Drive for Electric Car Axles, a Novel, by L. J. Monahan........ 318
Electric Farm Machines, the Portent of........ 155
Electric Systems Simpler........ 919
Electric Truck with Trolley Battery........ 225
Empire 1-ton Axle Has No Differential........ 822
Engine, Aluminum in France........ 15
Engines for 1917 a Culmination of Refinement........ 797
Engine, Four is Ultimate, by Brush........ 1006
Engine, 4-cyl., Best Tractor........ 982
Engine, Knox Aviation........ 856
Engine, Martin Aviation........ 188
Engine, Rutenber........ 58
Engine, Sawtelle, Has Two Fuel Grades........ 275
Engine, Schoenrock........ 811
Engine, Wisconsin Aeroplane........ 18

ENGINEERS' FORUM

Air Cooling and Two Cycle to Solve Troubles, Duryea........ 718
Alcohol-Benzol Fuel........ 282
Aluminum-Steel Piston, W. H. Bishop........ 718
Battery Care on Stored Cars........ 1052
Brake in Alps, Cars Need Hand........ 152
Brake Thermal Efficiency Era........ 973
Cost, Greater Economy in Running, V. A. N.........616
Crankshaft Inaccuracy, Permisible........ 239
Diesel Engine, Semi, by Strickland........ 973
Differential Experiments, Should Conduct, Birdsall........ 70
Differential, Resistance, by Squires........ 70
Dust Out of Cylinders, Device to Keep, F. S. Orein........ 617
Electric Omnibus Cost Averages 9c. Per Mile........ 538
Fenders Rattle too Much, Crilley........ 70
Filter Dust from the Air........ 538
French Emissary Excluded from American Bearing Plants........ 538
Gear, Wants Lower 2nd........ 898
Grade, 100 per cent........ 898
Horsepower Curves for Tractors........ 939
Kerosene and Water Cooling, H. J. Klina........ 616
Kissel Names, All-Year Car and Hundred Point Six........ 152
McQuay-Norris Patented Name is Leak-Proof........ 152
Motion Analysis of Rolling Automobile Wheel........ 192
Noises, No Provision Made For, M. K. Woodford........ 617
Railway Trucks Coming........ 239
Running Boards, Advantages of Metal Mesh-Type of........ 152
Semi-Floating Spells Economy........ 324
Spring Attachment as Shackle-Bolt Rattle Eliminators, G. E. Wendel........ 719
Tires Pumped Too Hard........ 1071
Tractor Requirements for General Farm Use 538
Trucks, Overloading and Rating........ 1070
Two-Cycle Construction with Features, McIntosh........ 281
Two-Cycle Engine Development Neglected 193
Two-Cycle Problems Solved, Kline........ 325
Two-Stroke Engine, Hinkley........ 70
Universal Joints in 1905........ 70
Vacuum Brake, Criticizes, Brayton........ 1016
Valve Capacity, Correcting, by Delling........ 973
Wheel Motion Correction........ 282

Engine Rating, by E. G. Ingram........ 700
Eynon Heavy-Fuel Carbureter Uses Electric Heat........ 401
Farm Motor Machines at British Show........ 153
Fuel, Lower, is Greatest Carbureter Problem. 1019
Fuel, Pre-Heating........ 707
Garage Repair Kit—Eliminating........ 526
Gas, Running on Town........ 618
Gasoline from Natural Gas........ 777-896
Gasoline Gravity Does Not Mean Power........ 609
Gearing Pocketbook........ 977
Gearsets........ 843
Glare Eliminating is Easy........ 674
Goodyear Cord Tires Easy to Repair........ 971
Gravity, Determining Center of, and Moment of Inertia........ 50
Headlight Glare, Determination of, by Replogle 890
Headlight Glare Eliminating is Easy........ 674
Heat Deteriorates Cast Iron........ 406
Hudson Fits Dash Radiator Control........ 853
Ideal Truck, Engineers to Specify........ 572
Ignition is Much Improved........ 961
Jack Shortcomings........ 139
Kerosene Standard Tractor Fuel........ 397
Kerosene Activity in England........ 404
Knox Aviation 12 Tested........ 856
Lock for Brakes, Goldmerstein........ 142
Lubrication, Pressure Advantages, by Clayden. 1008
Magneto, Berkshire........ 105
Magneto Changes........ 967
Manifold, Warming for Using Heavy Fuel........ 1007
Monahan's Electric Car Axle Drive........ 318
Motion Study as a Production Factor........ 854
Nomenclature, Automobile........ 34
Oil Carbonization Due to Oxidation........ 283
Piston Progress Illustrated........ 934
Pittsfield Distributer Has Make and Break Both Positive........ 180
Pneumatic Tire and Rim Situation, by J. E. Hale........ 64
Power in Cylinders, Securing, by Antony........ 267
Production, Conveyor System Aids Big........ 100
Rectifier for Battery Charging........ 539
Rubber, Attachment to Metal........ 1112
Shipping Device for Increasing Security........ 396
Silence = Continuous Noise........ 48
Spark Type Affects Power........ 970
Spring Action, Getting Correct Front, by Dyke........ 236
Spring Design, by Clayden........ 393
Spring, North Adjustable Cantilever........ 157
Starting and Lighting, A-B-C........ 412
Steam Cars, Past and Present........ 781
Steering Gears........ 839
Storage Battery—What Happens to a Neglected........ 518
Tank, Carter Pump Fuel........ 1113
Temperature Control Will Be Elaborate........ 478
Testing Method, Roesch........ 1048
Tests Show Car Condition........ 6
Throttle Lever, Why a........ 135
Thermoid Disk Coupling Replaces Steel........ 820
Torque and Ratio Determine Drawbar Pull........ 349
Tractor Drives Knotty Problem........ 474
Tractor Embodies Many Features Gaso-Kerosene........ 460
Tractor Transmission Serious Problem........ 527
Tractors, Caterpillar Advantages........ 184
Tractor Design, Auto Practise in........ 434
Tractor Rating by Drawbar........ 13
Transmission, Radcliffe........ 1108
Transmission, Electric, Siedel........ 1112
Truck Design, Refinements, by Church........ 20
Truck—Effect on Industry of Standard........ 444
Truck and Tractor Engines, Horning........ 446-480
Turpentine as Fuel........ 603
Universal, Walker, Has Cast Iron Bearing........ 28
Vail Tractor Uses Gasoline or Kerosene........ 460
Valve Sizes Need Definition........ 700
Laminated Wood Wheel Construction........ 430
Wheel, Army Truck, Search for........ 24-60-112

TRADE NEWS

Abbott Downing Trucks on Market........ 832
Abbott to Build in Cleveland........ 827
Abbott Buys 6 Acres in Cleveland........ 381
Abler Opens New York Office........ 508
Acme on Way—3½ Ton........ 513
Acme Truck Doubles Capital........ 372
Acme Truck Maker to Add........ 916
Acme Truck Worm Axle........ 830
Adams Trucks No More........ 168
Adrian Castings Plant Burned........ 213
Advertising, Is It Potential........ 954
Aeroplanes, Wants Funds for........ 2
Agrimotor Will Design Tractors........ 588
Agnew Directs Chalmers Advertising........ 643
Aitken Used Goodrich Silvertown Cords........ 551
Ajax to Buy Racine Co........ 991
Akron, Miracle Tire City........ 870
Akron Rubber Mold Increases Capital........ 549
Aland 16-Valve 4 Coming........ 117
Alford, Nash Comptroller........ 590
Alford Nash V-P........ 728
All Steel Car Charter Asked to Be Forfeited........ 1079
Allen Bour-Davis Southern Sales Manager........ 836
Allen Compensating Axle on Market........ 871
Allard on Torpedoed Ship........ 337
Allen Adds 2 Closed Bodies........ 650
Allen at $850........ 117
Allan Holds Dealer Convention........ 201
Allen to Drop $795 Car........ 1035
Allen Raises Closed-Car Prices........ 950
Alliance Tire, New 3,500-Mile........ 836
Alliance Tire to Expand........ 372
Aloin Heads Schoeneck Co........ 730
Alter Erecting Plant in Grand Haven........ 867
Alvord Succeeds Hendee........ 127
American Car is a 6........ 248
American Chain Salesmen Inspect New Plant. 502
American Chain Takes Standard........ 992
Amazon Tire Adds........ 734
American Chain Buys Standard........ 731
American Jack Has New Name........ 287
American Junior to Compete with Jinrikisha. 342
American Motors Plant Completed........ 549
American Motors Plant Adopts 8-Hr. Day........ 683
American Tire Buys $90,000 Plant........ 382
American Vanadium Co. Sold for $7,000,000........ 301
Ams-Sterling at Amston........ 832
Anderson and Young Promoted........ 951
Anderson is Madison Sales Manager........ 598
Anderson Motor Co. Formed........ 997
Anderson Sales Gain 141%........ 792
Anderson Buys Chicago Electric........ 683
Anderson Electric Expands Cleveland Plant........ 870
Anderson Steam Vulcanizer Co. Formed........ 634
Aniser Becomes Mechanical Belt........ 833
Autocar Issues $1,250,000 in Bonds........ 590
A. O. Smith Insures Every Employee........ 287
Apperson in New Plant........ 953
Apperson Denies Sales Rumors........ 546
Argentina-Fosters Trade with........ 460
Argentina Mercantile Corp. Formed........ 993
Argentine Trade-Mark Law........ 629
Armleder Truck Prices........ 203
Armored Car, Invents Two Wheeled........ 501
Armored Cars to Have King Chassis........ 117
Armstrong Tire Plant to Operate........ 459
Army Light Truck Orders........ 77
Army, Shop Truck Order........ 77
Army Truck, Ideal........ 378
Assmus to Cuba for Maxwell........ 871
Atlas Drop Forge Increases Capital........ 874
Atlas Forge Declares 100% Dividend........ 459
Auburn Adds 4-Story Building........ 632
Austin Increases Prices........ 991
Auto Body Co. Addition........ 203
Auto Body Increases Floor Space........ 870
Auto Crank Shaft Corp. Formed........ 556
Auto-Lite, 75 Men Convince........ 959
Automobile Lock Co. Formed........ 915
Automobile Telegraphic Code on Market........ 790
Auto Wheel Increases Capital $200,000........ 733
Auto Specialties Absorbs Mich. Malleable........ 684
Auto Securities Corp. Formed........ 513
Autocar Increases Capital........ 40
Avery Tractor Maker's Capital $2,300,000........ 792
Aviation Experts on Joy Field, Photo of........ 953
Babson Conference........ 501
Bache of Bound Brook Bearing Dies........ 551
Backus Ford's Baltimore Manager........ 165
Baker Cole Eastern Sales Manager........ 246
Baker in U. S........ 125
Baker Resigns from G. V........ 830
Baker Takes Atlantic and Horner........ 916
Baekeland Discusses Synthetic Resins........ 877
Bailey to Manage Cook's Pat. Assn........ 598
Baldwin Is Saxon Service Manager........ 737
Ball & Ball Carbureter on Winton........ 993
Ball & Ball Co. Formed........ 876
Banta Is Premier Vice-President........ 684
Barley Cars Painted to Suit Buyer........ 506
Barley Increases Wages........ 915
Batavia Claims Discrimination in Freight Rates 952
Batchelder Asst. Sales Mgr. Dort........ 427
Bates Predicts Higher Material Prices........ 792
Battery—U. S. Caterpillar........ 501
Be Saw capital now $220,000........ 590
Bearings on British Embargo List........ 506
Bearings of Pa. Branch in Chicago........ 508
Bearings Service Co. Organized........ 371
Belden Overland Chief Engineer........ 827
Belgian Engineers Arrive........ 588
Bela Body Co. Buys Plant........ 373
Belgian Automobile Engineers in Detroit........ 912
Benford Need Not Change Form of Plugs........ 78
Bennett Perfecting Distribution Plan........ 914
Berger and Thompson with Abbott........ 728
Bernhardt and Hacquebart Join Harroun........ 635
Bethlehem Truck Ready in Feb........ 993
Bias is Mitchel Pur. Agent........ 598
Bill & Decon Resign from Nash........ 469
Black and White Taxicabs in New York........ 737
Blagden American Malleable President........ 1081
Blevins & Davis in Merger........ 508
Boone Is Disco Chief Engineer........ 509
Borland Wheel, to Make........ 833
Bosch Closes 11 Contracts........ 550
Bosch Magneto Adds Again........ 502
Boston Dealers Back Jordan Agency........ 383
Boston Repair Work 85 Cents an Hr........ 382
Bound-Brook Oilless Bearing Co. Adds........ 502
Bour-Davis Starts Production........ 683
Bour-Davis Cars, Takes 500........ 549

Bower, 100% Dividend, Recommends 648
Bower 15% Dividend 120
Bower, H. A. L. Sales Manager 117
Bowser Buys Site for Addition 686
Bowser Promotes Four 204
Bowser Treasurer Resigns 421
Boydston Dauch Sales Mgr. 1036
Bradley on Italian Front 734
Bradley Is Paige Pur. Agt. 427
Bradt is A. B. C. Sales Manager 546
Braender Dies 828
Brewster & Co. Joins N. A. C. C. 789
Briggs-Detroiter Capital Reduced 1040
Buick Builds 563 Cars Daily 953
Buick Expansion, $1,900,000 1075
Briscoe Plants for K. C. and S. F. 831
Briscoe Plant on West Coast 870
Briscoe Prices Increased 1076
Briscoe's Prediction—5,000,000 in 1919 546
Briscoe Holds Get-Together Banquet 551
Britain Bars U. S. Cars July 16 39
Browne Heads Anderson N. W. Division 299
Brown Is Scripps Sales Mgr. 908
Brown Leaves Premier 78
Brown-Lipe-Chapin Sold 641
Brown-Lipe Gear Buys Deere Plow Plant 343
Brown Takes Lubricating Bolt 337
Brunswick Balke Tire Plant Contract Awarded 502
Brooks with Madison Motors 877
Brunswick Tire Plant Nearly Ready 1038
Brunswick M. C. Co. Formed 833
Buckwalter is Timken Engr. 471
Buckwalter is Timken Bearing Engr. 551
Bucyrus Rubber Elects Directors 995
Buda Motors to Sell Direct 256
Budd Starts Plant Addition 203
Budd Wheel to Enlarge 631
Buffalo Pressed Steel Co. Expands 204
Bullock Co.'s Tractor Demonstration 737
Buick, $1,000,000 Additions for 1034
Buick Price Increase 1035
Buick Adds Four 1
Buick, Demountable Top for 681
Buick Expansion, $1,900,000 1075
Bukholt Tire Protector in New Plant 870
Bardick and Hegerman Control Central Wheel 163
Burgess Resigns from Dorris 829
C. & C. to Handle R. I. V. Bearings 836
Cadillac Prices $160 Higher 991
Cadillac, $2,000,000 Plant for 833
Calmont Resigns from Jackson 504
Campbell Mfg. & Foundry Co. Formed 547
Canada Uses 30% More Gasoline 790
Canada Farmers Prosperous 791
Canadian Provinces in West Buy 8,000 Cars 294
Canton Auto Parts Mfg. Co. Formed 642
Caples Goes to Overland 208
Cardway Represents Packard in S. A. 246
Car Builders to Co-Operate with Electric Device Makers 1056
Carlton is Bosch 'Frisco Mgr. 687
Cushing In on an Ill Wind 341
Cassidy Handling Corning Conaphore 791
Cassidy Gets Kimball Jack Sales 204
Canaan Joins Chalmers 1075
Ceylon Import Duty Increased 506
Chalmers Assets Gain 50% 213
Chalmers Increases Wages Ten Per Cent 1081
Chalmers Promotions 950
Chalmers to Raise Prices $70 597
Chalmers to Retire from D. A. C. Presidency 993
Champion Adds 63
Chandler Export Office Moves 513
Chandler Starts New Assembly Building 588
Chandler 1% Extra Dividend 956
Chandler Plans Addition 383
Chandler to Continue Present Model 599
Chandler 2% Extra Dividend 421
Chalmers Motor Corp. Formed 727
Chandler Increases Wages 10 Per Cent 1081
Chile, U. S. A. Cars Gain in 732
Charging Station in Melbourne, Elec. 506
Chalmers Motor Corp. Chartered 787
Chamberlain Heads Packard Trade Sales 1075
Champion Spark Plug Men Meet 1042
Charter Oak Under Way 787
Chapin and Coffin Return from Mexican Border 867
Charter Oak on Market Next Spring 909
Charter Oak in New Britain 1081
Chase Joins S. A. E. Office Staff 950
Chase Raises Some Prices 909
Chase Makes Changes 631
Chase to Add 3-Tonner 213
Chevrolet, All Weather Top for 681
Chevrolet, Canadian Expands 910
Chevrolet's Great Development 736
Chevrolet, 54,700 During Year 287
Chevrolet $490 Electrically Equipped 341
Chevrolet Promotions 837
Chevrolet Purchases Warner Plant 3
Chevrolet Sells 8,000 Canadian Cars 832
Chevrolet to Add in N. Y. 80
Christansen Goes to Detroit 1079
Christinens Returns to England 636
Chrysler on General Motors Directorate 47
Auburn $60 Higher 1035
Cleveland Dealers to Protect Buyers 506
Cleveland Makers Using Tents 372
Clodio to Concentrate on Houdaille Shock Absorber 996
Cocorda and Giangue, Peugeot Engineers, Here 871
Coffin Goes to Europe 167
Coffin on Defense Commission 641
Cole Adds All-Weather Body 39
Cole Heads Perfection Tire Co. 910
Cole Price Raised $100 827
Cole Service Conference 836
Colfax Buys Top Co. 634
Collins Chevrolet Sales Manager 950
Collins Joins Harroun Staff 1078
Collins to Join Parker Rust Proof 869
Colt is Cole Eastern Mgr. 119
Columbia Motors Buys Argo 556
Columbia Motors Leases Boat Plant 684
Columbus Gear Co. Busy 373
Columbia Truck Increases Capital 1043
Comet Buys Plant Site 1037
Commerce Enlarges and Adds Model 588
Commercial Auto Body Co. Formed 787
Commerce Truck Expands 552
Consolidated Now Abbot Corp. 299
Colonial Motors Making Deliveries 734
Continental Begins Another Addition 502
Cotinental Motors Service Stations 1078
Continental Pays 5% on Common 40
Continental to Build Machine Shop 287
Corcoran Mfg. Co. Expands 1037
Cordin Leaves Packard 867
Cork, Trucks to be Built in 1042
Corman Is Denneem Sales Manager 203
Cornelius with Parker Rust Proof 869
Corliss Truck is Unique 685
Cornell Cole Assistant Sales Manager 830
Covert Retires 1035
Cotton Prices Boost Car Sales 687
Cotta Transmission Expanding 588
Couzens Heads Detroit Police 590
Covert Gear Co. Is Incorporated with $1,000,000 383
Crankshaft Corp. Issues Stock 643
Crawford Founder Dead 691
Crew-Lewick Sold to Syndicate 117
Crow Again Changes Name 957
Crow-Elkhart Motor Co. now 513
Crow Much Larger 291
Crowther Chassis on View 501
Cummins Monitor Capital $100,000 40
Cummins-Monitor Reorganized 828
Cutting, Armstrong & Smith Seek Site for Plant Addition 372
Daimler Representative Describes Tanks 686
Dallas $25,000,000 Distributing Center 94
Daniels Price Raised $200 341
Dann Factory—Pushing Work On 457
Dann Products Opens Cleveland Plant 870
Dann to Make Self-Oiling Bearing Material in New Plant 371
Daniels, Capital $250,000 205
Darling Motor Co. Incorporated 549
Davidson Resigns from Continental 427
Davis & Blevins in Merger 508
Dayton Steel Wheel Co. Incorporated 549
Dayton Wire Wheel Co. Formed 1075
Day Elder Motors Corp. Incorporates 1076
Day and Warner on G. M. Board 40
Dazey Joins Chalmers Co. 834
Dealer $14,000,000 Merger 916
Decker Top Increases Capital 914
Decon & Bill Resign from Nash 469
Dechant Heads Case Advertising 589
Decker Buys Universal Car Equipment 998
Delco Record Shipment 910
Dennet Resigns from Packard 950
De Lorenzi Sails for England 950
Demonstration—1,000 Cars in Highway 551
Denmark Likes U. S. A. Cars 955
Doumo Is New Truck 334
De Palma Mfg. Co. Buys Plant 427
Detroit Electrics in Quantity 910
Detroit Motor Lock Co. Formed 735
Detroit to be Aviation Center 908
Detroiter Adds $1,098 Roadster 161
Detroiter Coupé and Sedan 1081
Detroit's 1916 Output 960,000 868
Dentsch & Bell Factory Reps. 693
Devlin Joins Elgin Corp. 203
Diamond 300% Cash Dividend 40
Dickinson with Champion Motors 1043
Disbrow Motors Co. Organized 915
Disco reduces Ford system $10 727
Dixie Increases Capital to $400,000 1039
Dosk Joins Ohio Electric 869
Doak Joins Ohio Electric 686
Dobbeer Willys-Overland Treasurer 785
Doble Steam Car in Detroit 335
Dodge to Build Plant 730
Dodge Resigns from Houk 341
Dodge Will Have Carpenter Shop 338
Doehler Adopts 10% Wage Dividend 1037
Donahue Is Ross Asst. Sales Manager 546
Dorris Discontinues 1,500-Pounder 953
Dort Director of Guaranty Securities 910
Dort, 4 Models for 1917 1080
Dort Price Raised to $695 167
Draker Returns from Orient 256
Drexel, Scofield Sales Mgr. 1080
Drexel Succeeds Farmack 118
Dudley Federal Truck Advertising Mgr. 830
Dunlap Leaves Hupp 459
Dunlop Originated Cycle Tire 1042
Duplex Truck Co. Formed—$1,000,000 capital. 871
Durant Denies $700 Eight Report 212
Durant Interests Back of N. Y. Building 378
Duplex Acquires Plant Site 1076
Duplex Earned $41,110 in 1916 287
Dynamometer Set for U. of Wis. 633
Duryea $4,000,000 Company to Build $250 Car 950
Earle & Boggs Enlarge Accounts 836
Earle & Boggs Leave Continental 2
Earle & Boggs Take Buda Motor 1001
East Palestine Capital $1,000,000 1040
Eastern Motors Syndicate Formed 597
Eastman Heads Philadelphia Packard 594
Eaton Torbensen Axle Manager 830
Economy and Bellefontaine Merge 1081
Edwards Joins Automatic Carbureter 829
Eisenberg Is Scripps-Booth Engineer 642
Eisenhuth Motor Co. Formed in Los Angeles. 995
Elcar 1917 at $795 426
Electric-Pneumatic Gearshift Corp. 955
Electric in Boston $500 502
Elgin to Add 631
Elgin Capital Now $3,500,000 208
Elgin Motor Corp. to Add 831
Elkhart Increases Capital 874
Elliott, Haynes Production Manager 2
Ellis-Smith Replaces Rub-On 504
Emerson Buys Kingston Plant 728
Empire Axle Plans Large 1917 Production 730
Empire to Raise Prices 869
Empire Inclosed Car 876
Empire Tire Refinancing 874
Empire Tire to be Refinanced 828
Estep goes to Salonica 736
Engel to Promote Oldsmobile Sales 790
Engine-Testing Method, New 994
England Wants U. S. A. Ideas 955
Enger M. C. Co. Formed 287
Enger New Financing 336
England to Control Gasoline 78
Erbes to Concentrate in St. Paul 373
Erickson Building Front-Drive Truck 833
Eubanks Resigns from Barley 117
European Automobile Conditions 662
Europe Establishes Standards 126
Everitt Tractor Tried Out 650
Falcon, a 4-Wheel Drive 1076
Falls Machine Under New Control 127
Falls Motors Plans 120 Engines a Day 257
Farr Leaves S. K. F. Bearing Co. 906
Feeley Supt. Pittsburgh Maxwell Plant 959
Fergus Car for Next Year 2
Fergus Moves Offices to Newark 1082
Ferguson Resigns from G. M. 127
Fines in Wisconsin—Must Refund Fines 550
Fifth Avenue Buses Earn $1,669,726.18 685
Fines in N. Y. Traffic Court Severe 256
Firestone Gives $1,000,000 for Welfare 833
Firestone Holds Sales Convention 651
Firestone Stock Sold $5,000,000 512
Firestone Making 12,000 Tires a Day 457
Firestone Sales Increase 38% 121
Firestone Stock $50,000,000 421
Firestone Capital to be $15,000,000 785
Firestone, R. J., Now Vice-President 828
Firestone to Add 372
Fisher Body Buys Regal Plant 787
Fisher Body Corp. Formed 248
Fisher Body to Expand 161
Fisher Body Sales Record 832
Fisher Body Sales Increase 1084
Fisher Farm Tractors Tested 958
Fisher in Tractor Co. 871
Fisk Ratifies Increase of Capital 793
Fisk Capital Now $39,500,000 555
Fisk Capital Increase, to Vote 470
Fitch, Tractor Inventor, Dead 953
Flanagan Heads Pyrene Sales Dept. 213
Flint Feels Shortage of Cars 952
Foote, H. A. L. President 381
Forbes, W. J. Dies 78
Ford Adds 34 Branches 161
Ford Agencies Increase Rapidly in Every City 300
Ford, Canadian Earnings $5,000,000 121
Ford Boycotted by Britain 647
Ford Cars to Use Kerosene 871
Ford Distributes 850,000 503
Ford in Canada Earns 15.8% 650
Ford (Canadian) Copies Selling Plan 513
Ford, Canadian, Passes Dividend 685
Ford Loses First Court Tilt 1034
Ford Profits Held Up by Injunction 786
Ford, 533,921 Built in 1 Year 212
Ford, 56,539 in Oct. 1080
Ford Plant in England 631
Ford, Canada, to Make Trucks 728
Ford, Temporary Injunction Against 997
Ford Tractor Capital Now $10,000,000 957
Ford Raises Probationary Salary 685
Ford Profits $59,994,118 381
Ford Radiator, New 257
Ford, 700,000 in 1917 867
Ford Tractor Formed in Del. 871
Ford Holds Sales Conference 41
Ford 1-Ton Worm Drive Truck 211
Ford Plant Closes for Week 1080
Ford Prices Cut 167
Ford Salesmen Form Agencies 291
Ford Sales Plan May Be Copied 599
Ford to Drop Retail Sales 255
Ford Tractors at Fremont 252
Ford Victor in Appeals 1077
Ford Wins Windshield Case 1077
Fosdick Plans Automobile Company 836
Fostoria Light Car Petitions 547
Fostoria Raises Prices 5
Fostoria to Change Name 1040
Four Drive Capital $200,000 549
Four Wheel Takes Over Utility 998
Four Wheel Tractor Co. Elects 204
France Lowers Truck Duty 45
Franklin $100 Higher 1035
Franklin to Increase Production 730
France Orders 600 Moreland Trucks 127
Freight Car Shortage Serious 629
Fremont Tractor Show Draws 90,000 255
French Adopt Uniform Carbureter 212
French Makers Plan Cheap Cars 125
Friend Is United Motors Vice President 167
Friend Returns to Mitchell as President 469
Fritz Leaves Motor Appurtenances 959
Fuel Research, $10,000 for 955
Fuller Output Worth $700,000 504
Fuller & Sons Output Increased 338
Fulton Takes C. & E. Products 836
Gardner to Retire 1079

Gary Truck Capital Doubled........ 914
Gasco Mfg. Co. Formed........ 787
Garage Labor Prices Higher in Wis........ 290
Gasoline, Casing Head, Production Increased 53%........ 634
Gasoline Cards in France........ 917
Gasoline Dispenser, to Make Visible........ 504
Gasoline from Canadian Shale........ 249
Gasoline Lower in Ohio........ 505
Gasoline Prices Raised........ 998
Gasoline in N. Y. Reaches 22 Cents in Decline 420
Gasoline, 140,000,000 bbl., in First 6 Months. 43
Gasoline Pumps Are Inaccurate........ 648
Gasoline Statistics to Reduce Prices........ 80
Gasoline Tests Not Simple........ 692
Gasoline Exports, Sept., Increased 83%........ 724
Gasoline Pumps, 70% Tested and Inaccurate. 792
Gasoline, Texas Reduces Price 1 Cent........ 735
Gaston, Williams & Wigmore Profits $10,000 a Day........ 45
Gaulois Tire to Build in U. S........ 868
Gauvreau Joins Buick........ 992
Gearless Differential Reduces Prices........ 42
Gebl Bros. Make Tractor........ 276
Geiger-Jones New Issue Preferred........ 120
Gemco to Market Products Direct........ 546
General Bearings Corp. to Take Over Standard Roller........ 504
General Engineering Directorate Completed.. 995
General Motors, $2,250,000 per month........ 867
General Motors Securities Listed........1019
General Motors Builds Plant........ 877
General Motors Capital Is $102,600,000........ 641
General Motors Opens Marquette Plant........ 909
G. M. Corp. $100,000,000........ 511
General Motors Earnings $25,000,000........ 827
General Motors Fiscal Statement........ 167
General Rubber Increases Capital........ 250
General Tire Adds Two Directors........ 599
General Tire to Increase Capital........ 383
Geronimo Plant for Enid, Okla........ 913
Giants Despair Climb Oct. 7........ 507
Gheut, Two 1917 Models........ 997
Gibson Plant Burns........ 126
Giesel Federal Truck N. E. Sales Mgr........ 633
Gillette Tire to Start Dec. 1........ 734
Gillett Buys Out Wilmo........ 118
Gillette Tire Installing Machinery........ 870
Gillam Co. Plans Capital Increase........ 876
Gillette to Build Sleeve Engine........ 78
Girl Heads Standard Parts........ 993
Glide to Make Its Own Motors........ 830
Globe Business Gains 40%........ 634
Gloetzner Covert Chief Engineer........ 868
G. M. C. Common Up $120 in Week........ 505
G. M. C. Feature Securities........ 459
Gilbreth Talks on Motion Study........ 688
Globe Tire Buys Plant........1038
Golde Top to Add........ 161
Goldman to Build Trucks........ 833
Goodrich, $70,000,000 Sales for........1039
Goodyear Profits $7,003,330........ 952
Goodyear Secures Cotton Plantation........ 731
Gerlinger Tractor Attachment........1042
Goodrich Accessory Assn. Changes Name.... 911
Goodrich Additions Total $500,000........ 382
Goodrich Gross Sales May Reach $77,000,000.. 635
Goodrich Profits for 6 Months $4,800,000.... 168
Goodyear Adds to Agents........ 512
Goodyear Plant in East Toronto........ 383
Goodyear Employees Get More Land for Homes........ 382
Goodyear, 28,500 Tires a Day........ 42
Gordon Is Hudson Traffic Mgr........ 685
Gram-Bernstein to Expand........ 546
Grant Earns 78,000 in August........ 505
Grant Moves to Cleveland........ 952
Grant Will Move........ 909
Grant, 18,000 for 1917........ 647
Graves Joins Russel Axle........ 830
Gray Heads Hess-Bright........ 598
Grossman Holds Sales Conference........ 118
Grossman Reincorporates........ 834
Gryphon Tire Co. to Expand........ 734
Guy Resigns from Advance-Rumely........ 78
H. & N. Plant in L. I. C........ 547
Hackett Resigns Presidency........ 683
Hackett 4 at Under $1,000........ 125
Hall Joins Pathfinder........ 591
Hal M. C. Co. Now........ 684
Hal Prices Increased........1076
Hall Lamp Buys Badger Lamp........1076
Hall resigns from Olds........ 125
H. A. L. Plans Greater Business........ 456
Hamilton Chief Engineer for Oakland........ 598
Hamilton, Ont., Gets Tire Co........ 550
Hammers Hackett Consulting Engineer........ 828
Harding Takes Up New Detroit Job........ 589
Hare Heads N. Y. Packard........1043
Hare Packard Sales Mgr........ 41
Harkness Resigns as Sheepshead Pres........1000
Harrison with Harroun........1038
Harrison Radiator Granted Charter........ 999
Harroun Cars, 2000 to Be Exported........ 557
Harroun, First Building Foundation........1082
Harroun Plans 5-Year Contracts........ 691
Harroun Motors Begins Building........ 735
Harroun Motors Buys Plant........ 502
Harroun Cars by Show Time........ 427
Harroun to Make 24,000 Cars........ 635
Harroun Treasurer's Office in N. Y........ 548
Harvey Adds Heat Treating Building........ 456
Hassler Building Absorber Factory........ 287
Hastings Is Empire Consulting Engineer.... 203
Hastings Goes with Empire........ 246
Hastings Empire Engineer........ 256
Hatch Perfection Spring Sales Manager.... 555
Hatch Heads Perfection Spring Sales........ 471
Hatfield Roadster at $875........ 5
Harroun to Complete Factory by Spring.... 833
Haumann Wants Represent Tires in S. A.... 832
Haynes to Add 600,000 sq. ft........ 831
Hastings Holley Chief Engineer........ 868
Hayes Capital $1,500,000........ 999
Hayes Wheel Co. Adds $500,000........ 792
Haynes Plans Increased Production........ 910
Haynes to Extend Office........ 547
Haynes, 1897 Model Wins........ 637
Haynes 108% Stock Dividend........ 255
Haynes Sold to N. Y. Syndicate........ 341
Heater Heads Bucyrus Rubber........1034
Hebner Joins Bearings Service Co........ 341
Heinze Concentrates on Ford Starters........ 995
Hench & Drongold to Make Truck and Auto Bodies and Parts........ 502
Herman with Bour-Davis........ 867
Herreshoff Co. in Bristol, R. I........1043
Herschell-Spillman Adds New Model........ 306
Herschell-Spillman Expands 25%........ 631
Herschell-Spillman Enlarging........ 382
Herschell-Spillman 100% Dividend........1085
Hess-Bright in Bankers' Control........ 829
Hibbard Is Regal Asst. Sales Mgr........ 906
Highway Tractor Co. Formed........1033
Higrade Motors May Locate in Grand Rapids 78
Herschell-Spillman Capital Tripled........ 951
Hilborn Takes Over Answer Plug........1036
Hilts Enters Advertising Agency........ 910
Hinckley Heads Chalmers Production........ 125
Hoffman Capital Now $100,000........ 549
Holiban Completes New Plant........ 831
Holland Joins Myers Machine........1080
Holley Kerosene Carbureter........ 683
Holmes Building Own Car........ 993
Homer Laughlin Builds 8-Cylinder Front-Drive Car........ 5
Hood and Batterill Open Detroit Office........ 118
Hood Bureau Increases Scope........ 633
Holt-Welles Elects Officers........ 731
Hoover Steel Ball Grows Fast........ 649
Hoover ¾-Ton Delivery Car........ 909
Horning and McKinley Councillors........ 127
Houghton-Stout Co. Buys Tractor Company..1075
Howard Car on Market........ 383
Hoyt Joins Bour-Davis........ 599
Hubbard Is Harris V. P........ 471
Hub Gas-Electric Truck Started........ 248
Hudson Engine in Test Runs........ 690
Hudson 1917 Price $175 Higher........ 597
Humpage Joins Wilt Drill........ 687
Humphrey Now in Detroit........ 827
Hughes Resigns from Victor Parts........ 684
Humphrey Joins Briscoe........ 117
Hupp Car Averages 18.96 m.p.g........ 460
Hupp Cap to Cap Car in Detroit........ 508
Hupmobile Capital-to-Capital Car at Fort George........ 422
Hopp Business Gains 47.3%........ 417
Hutchison Overland Branch Mgr........ 642
Hutchison to Make Truck Equipment........1038
Hydraulic Pref. Issue $1,000,000........ 504
Hydraulic Pressed Steel Redeems Preferred 591
Hydraulic Steel Co. Refinancing........ 906
I. A. L. Barred from U. S. Mails........ 213
I. A. League Agents Plead Guilty........ 547
I. A. L., Post Office Fraud Order Against........1077
Illinois Dealers Use Number Plates on Dem.. 506
Illinois Tractor Cultivator........ 376
Imperial Brass Co. Expands........ 503
India Bars Motor Imports........1075
Indiana, Fifth Industry in........ 290
Indiana Truck Capitol $100,000........ 549
Industrial Moving Pictures........ 633
Industry Gains 153% in Five Years........ 592
Insurance, Fire Rates Raised........ 955
International Motor Plans Exchange........ 168
International Motors Reorganization Approved 787
International Rubber Sales Co. Now........1038
International Truck Incorporated........ 827
Inventors Active Abroad, Automobile........ 530
Iowa Denby Dealers Meet........ 508
Iowa Rubber Co. Formed........ 299
Iowa Rubber Plant in Bettendorf........ 503
Irwin Leaves Adams to Join Allen........ 457
Italian Tire Plants Are Busy........ 456
Jackson Goes to Europe........ 993
Jackson Is Briscoe Comptroller........ 996
Java, U. S. Cars Popular In........ 958
Jeffery, Nov. Biggest Month........ 952
Jeffery Sedans, Two New........ 791
Jehle with Aluminum Castings Co........ 127
Jennings Bound Brook Advertising Manager.1078
Johns-Manville Gives Employees 10% Bonus.1037
Johnson Cars for R.R. Tracks........ 117
Jones Opens Detroit Purchasing Office........ 689
Jones with Federal Brass Works........ 341
Jones Federal Brass Sales Mgr........ 295
Jordan Builds Five Cars a Day........ 373
Jordan Starts Manufacturing........ 3
Jordan to Double Capacity........ 647
Joy Resigns from Packard........ 999
Kankakee Headed by Chiniquy........ 337
Kansas City Dealer's Tour Brings Sales.... 693
Kansas City Sales Gain 50%........ 120
Kansas City Tire Directors........ 204
Kearns Is Lee Tire Mgr........ 996
Keller Tool Moves to Grand Haven........ 456
Kellogg Adds to Factory........ 547
Kelly-Springfield Plant, Work Started........ 909
Kelly-Springfield May Move........ 502
Kelly Truck Capital $7,000,000........ 649
Kelly Truck—More Capital For........ 551
Kelsey Wheel to Expand........ 549
Kelsey and Herbert in Merger........ 127
Kent Motors Car at $985........ 513
Kent Plant in Bellville........ 646
Kentucky Wagon Promotes Executives........ 546
Kentucky Crops Boost Car Sales........ 505
Kerosene Motors Co. Formed........ 832
Kerosene Oil Men's Fuel Choice........ 683
Kerosene Carbureter to be Made in Des Moines........ 588
Keystone Tire Plant for Pittsburgh........ 547
Kilborn Is Liberty Sales Manager........ 590
King and Winterson Join Chalmers........ 165
King Armored Car at Rock Island........ 422
King Increases Prices Again........1035
King Trailer Co. Formed........ 917
King Raises Car Prices $50........ 785
King Armored Car Tested by U. S........ 249
King Tire Opens Plant........ 832
Kilpatrick Is Hood Vice-President........ 427
Kissel Price Raise Dec. 1........ 827
Kissel Raises Prices........ 869
Kissels and Scripps-Booths Sunk at Sea.... 686
Kissel to Add 14,000 Sq. Ft........ 382
Kieldsen, Importers' Show Mgr., Dead........ 688
Klaxon—U. M. C. Buys........ 425
Klaxon Horn Warns of Gas Attacks........ 37
Klaxon Three at $3........1043
Knickerbocker Co. Reorganized........ 908
Knight Tire Co. Absorbed by Fabricord Tire Co........ 867
Koehler Absorbs Factor........ 372
Kokomo Rubber Refinanced........ 998
Kopf Opens Chicago Office........ 642
Kuhn Is Four-Wheel Drive Tractor........ 788
K. W. Ignition Buys Land........1038
Laciar Kent Sales Mgr........ 828
Lancia Adopts H. & N. Carbureter........ 594
Lane Is U. S. L. V.-P........ 728
Lane Here from Australia........ 871
Lane Trucks Out Soon........ 502
Lansing Foundry Elects Officers........ 458
Lansing Payrolls Large........ 382
Lascares Re-elected Salon Head........ 828
Latoni with Chalmers Advertising........1078
Leach Gets King and Dort........ 633
Leak-Proof Business........ 834
Ledwitch Joins Maxwell........ 121
Lee Tire Repeats Extra Dividend........ 205
Lenox to Make Tractors........ 642
Leonard Leaves Perfection Spring........ 827
Leverton Is Briscoe Plant Manager........ 246
Levy Gets Chalmers Again........ 692
Levy Takes Merion-Handley........ 117
Lewis, Goodyear Consulting Engineer........1075
Lexington-Howard Rayfield Equipped........ 594
Liberty Appoints Representatives........ 547
Liberty, Thirty-eight in One Day........ 693
Lone Drive Tractor Factory........1038
Logan Resigns........ 917
Livingstone Maxwell Cleveland Mgr........ 836
Lloyd Is Cassidy Adv. Mgr........ 994
L-M-H Development Co. to Make Tractors... 871
Lockwood-Ash Increases Capital........1040
Locomobile Holds Fourth Sale........ 508
Locomobile Gains $1,000,000 in Quarter........ 204
Loomis Manager Packard-Missouri........ 724
Loomis Resigns........ 2
Loewe Is Brunswick-Balke Manager........ 503
Longuet Buys Accessories for S. A........ 834
Lozier Bros. Co. Formed........ 829
Lozier Bros. Co. Announces New Cars and Officers........ 995
Lozier—Motor Products Gets Plant........ 427
Lozier Resigns as H-A-L Head........ 341
Lytle Joins Anderson Motor Co........1038
McFarlan Price Raised $300........ 909
Macey Harroun Sales Manager........ 869
McClurg Interests Control Three Tire Companies........ 957
McCord Assets $1,875,000........1040
McLeod Concentrates on Fabricord Co........1036
Mack Truck Prices Increased........ 991
Madison Stock Offered........ 875
Machine Tool Makers Adv........ 633
Madison Motors Acquires Anderson Plant.... 786
Madison 4-Pas. Roadster........ 912
Madison Motors Absorbs Old Company........ 556
Madison Square Garden Sold........1001
Maibohm to Increase Production........ 630
Makers Arrange Banquet Program........ 995
Manhattan Electrical Supply Reorganized.... 642
Manly Truck in New Plant........ 917
Manufacturers' Banquet, 400 at........1034
Marathon Tire Convention Starts........ 458
Marathon Warehouse in Chicago........ 832
Manhattan Electrical Supply Enlarges........ 684
Maple, Surplus in 2-in........ 731
Marathon Tire Increases Capital to $1,000,000 590
Marathon Tire, New........ 78
Market Report, Tenth Issued........ 420
Marvel Accessories Capital Increased........ 917
Marion Tire Elects Directors........ 688
Marmon Advance of $150........ 869
Master Calorite Plugs Adopted by P. O........ 502
McCulla in Overland Engineering Dept........ 828
Milburn Branch Mgr. for Hupp........ 837
Muir Heads Maxwell Advertising........ 994
Miles Lewis Motor Buyer........ 836
Monroe Increases Capital........ 728
Marmon Rushes Additions........ 730
Marmon Adds Closed-body Types........ 77
Marmon 34-in. New Closed-body Styles........ 108
Martin, Burd Ring V.-P. Retires........ 127
Massachusetts Suggests Precautions Against Fire........ 637
Massnick Mfg. Co. Now........ 648
Massnick Mfg. Co. Is New Name........ 547
Maxwell Price Increase........1035
Maxwell Assembly Plant for Dallas........ 502
Maxwell Earnings Gain........ 425
Maxwell Ships 550 in Day........ 546

Maxwell Builds 532 Cars in One day... 417
Michigan Foundry to be Doubled... 588
Maxwell Common on 10% Basis... 295
Maxwell Favtory Branch in Cleveland... 82
Maxwell Plant for Dallas... 502
Maxwell with Victoria Top... 97
Mayo-Skinner, More Room for... 831
McBride and Conlon Promoted... 127
McClure Tire & Rubber Co. Formed... 642
McComb Resigns from G. V... 126
McCord Capital Now $2,500,000... 248
McCornach Is Hudson Sales Mgr... 508
McFarlan to Make Expansion... 599
McGraw Rubber to Redeem $475,000 Preferred 250
McGraw Tire Capital Increased $1,000,000... 634
McQuay-Norris Men Promoted... 503
Merrill Purchasing Agent for Hood... 869
Merritbew Is Rayfield District Manager... 246
Metcalf a Simplex Director and Vice-President 299
Metropolitan Motors Organize... 374
Metz Has Balanced Crankshaft... 588
Metz Sales Plan Similar to Ford's... 599
Metz 1-Tonner at $695... 1035
Metz Welfare... 914
Meyer Resigns from Maxwell Directorate.. 1034
Michigan Production Increasing... 256
Miami Trailer Adds $10,000... 689
Michigan Wheel to Make Joints... 727
Michigan Stamping Stock Issue... 689
Mickim Heads Liberty Advertising... 647
Midland Tire Capital Now $500,000... 1040
Miller Is Inland Sales Head... 683
Milburn Raises Price $100... 77
Millar of Auto Parts Dies... 503
Miller Introduces Adone Tread for Repairing Worn Tires... 372
Milertire, New... 43
Milwaukee dealers on Business Boosting Tour 289
Milwaukee Dealers' Tour Ends... 416
Military Tractor Train Tested... 997
Milwaukee Locomotive Adds Tractors... 692
Mitchell $100 Increase... 950
Mitchell Refinancing Completed... 80
Moline Plow, $1,000,000 Additions for... 79
Monarch in Hyattsville... 831
Monroe Body, 2 New Buildings for... 161
Monroe Buys 4-Story Factory... 995
Monteith F. & H. Manager... 469
Moon Announces 5 Closed Bodies... 651
Moon Ships to Porto Rico... 914
Moore Heads Western Spring Sales... 641
Moreland Delivery Car, New... 203
Morgan Appointed Abbott President... 417
Morgan Sells Saxons... 594
Morron Succeeds Meyer... 1079
Moss Joins Thomas Truck... 127
Morse Succeeds Paul Smith... 555
Motor Products Gets Lozier Plant... 427
Murphy Resigns from Chalmers... 341
Murphy Joins Hoyt Service... 728
Murray Parts Increases Capital... 162
Muskegon Company Insures Employes... 1075
Muskegon Foundry Grows... 205
Mutual Motors Promotes Two... 471
Moyar Resigns from Champion Ignition... 869
Myers with Engineering Co... 868
Myers with Fageol Motors Co... 471
N. A. C. C. Opposes Scare Ads... 829
N. S. W. Shipments Not Economical... 1082
Nash Motors Co. Formed with $24,999,500 Capital... 168
Nash Takes Over Jeffery... 85
National and Premier Formed in N. Y... 686
National Carbon to Add... 830
National Plans for Expansion... 685
National Addition to Cost $150,000... 338
National Rubber Increases Mileage Guarantee... 1042
National Used Car Report, 11th Edition... 1042
Naville Absorbs More-Room Steering Wheel 117
Nelson Builds 4 at $2,350... 1038
Newby Resigns from... 992
Newall Purchasing Agent for Hood... 792
New Era Buys Accelerator... 917
New Era Buys Sly Tire Specialties... 599
New Jersey vs. Kane Decision... 950
Newman Resigns... 508
Newman Resumes Former Position... 594
Newman Chalmers Distributor... 41
New Zealand a Fertile Field for Automobile Sales... 732
Newmark Succeeds Eustis with Chevrolet... 598
Newton Joins Hollier Make... 127
New Departure to Double Output... 589
New York Dealers Upheaval... 85
N. Y. Electric Sociability Run Oct. 4... 550
N. Y. and N. J. Express Co. Is Formed... 590
New York Taxicab Rates Lower... 377
Nicholalds Branch In Indianapolis... 1042
Oakland Adding 800 Men... 287
Oakland Branch in Dallas... 43
Oakland to Add... 161
O'Connor Back from Australia... 834
Ohio to Drive Out Motor Leagues... 508
Ohio Rubber Plants Contribute 61% of wages 382
Ohio Tractor Co. Bought by Houghton... 250
Oldsmobile Branch Bought in Detroit... 378
Ollier Taboos Factory Convention... 338
Olympian Motors, Pontiac Plant for... 730
Olympian Motors Co. Form... 642
Olympian Officers in Pontiac... 837
Omaha to Have Closed Car Salon in Oct... 507
Ottawa Is Good Car Market... 376
Overland Adds $15,000,000 to Capital... 334
Overland Brings Out Sport Car... 876
Overland Buys Out Leavitt... 42
Overland Opens N. Y. Salesroom... 913
Overland Changes in N. Y. Organization... 161
Overland Pumps Water Off 5 Acres... 536
Overlands Burn in St. Louis... 917
Overland Men Take 25,825 Cars... 950
Overland, 154,525 Dealers Sold... 1038
Overland Earns $4,377,799 in 4 Months... 40
Overland's New Headquarters... 660
Overland 10% Stock Dividend... 120
Overland Convention in Dec... 788
Overland in Year 151,067... 512
Overland, 113,000 on Contract... 995
Overland Secures N. Y. Headquarters... 338
Overland 75-B Delivery Car... 665
Owen-Magnetics on 5-Day Tour 11... 461
Owen Tour... 492
P. R. Creditors Get Dividend... 1084
Packard Adjusts Organization... 867
Packard, J. W., Packard Dealer... 508
Packard Continues Expansion... 793
Packard Earnings About $6,050,000... 121
Packard Earnings... 683
Packard Opens Used Truck Department... 651
Packard, J. W., President of Buffalo Co... 1042
Packard Pfd. on 8% Basis... 999
Packard Raises Prices... 869
Packard Statement... 162
Page Buggy Adds to Force... 910
Page Plans Ford Starter... 248
Paige 1916 Gain $1,000,000... 555
Paige May Increase Capital by $1,500,000... 459
Paige, August a Record Month for... 425
Paige Dividend of 50%... 382
Paige Production Expands... 1082
Paige Raises Open Car Prices... 1035
Palmer-Moore to Quadruple Capacity... 831
Paige-Detroit Capital Increase... 875
Paige-Detroit Issues $1,000,000 Pfd... 999
Paige Distributers at Plant... 1043
Paige to Increase Prices... 869
Paterson Adds Chummey Roadster... 876
Paterson Chummy Roadster... 1081
Para Needs More Good Roads... 791
Parcel Post to S. A. Wrong... 911
Parker Rust-Proof Issues Stock... 957
Paris Buses Running... 378
Parker Collapsible Rim Corp. Former with $5,000,000 Capital... 343
Parker Rust-Proof Buys Patents... 1038
Parker Rust-Proof Plant at Flint... 1077
Paterson Chumming Roadster... 1081
Pearce Elected Pres... 1080
Peerless Starts Plant Expansion... 382
Peerless Order Increased to 100 a Week... 590
Peerless to Build Addition... 371
Peerless War Truck Order, Large... 299
Peerless Given Up by Silver... 735
Peerless Tire & Rubber Co. Formed... 1076
Perlman Stock on Exchange Basis... 732
Pennington Joins Brunswick-Balke... 127
Penn Counties Track Buys Land... 1082
Pennsylvania Rubber Lowers Prices... 551
Pennsylvania Crude Reaches $2.75... 957
Pennsylvania Has New Tread... 372
Pennsylvania Rubber Capital $6,000,000... 375
Perfection Heater Contracts, Two... 549
Perfection Heater on Cole... 77
Perfection Spring in U. S. Service... 43
Perfection-Stanweld Merger... 597
Perfex Radiator's New Plant... 632
Perfection Tire Merges with Two Companies. 833
Perkins-Campbell Adds 10,000 Sq. Ft... 343
Perlman, $1,010,000 Back Royalty for... 1034
Perry in U. S... 950
Perrin Resigns from Timken Axle... 556
Peter A. Frasse Co. 100 Years Old... 836
Peterson Joins Aloy Steel Spring... 2
Petroleum Output in 1915 426,896,673 Barrels 301
Petroleum Output Worth $179,462,890... 249
Pettit, J. I., Case V.-P... 868
Pettit Resigns from Case... 461
Peugeot Co. to Sell Premier... 43
Pfeffer and Brineger Go to Cuba... 993
Pfeffer to Retire from Chalmers... 906
Phelps Capital to be $400,000... 999
Pike Heads Paige Efficiency Department... 427
Pilot's 1-Model Program... 832
Piqua Tire, Fraud Order Against... 547
Pirelli Sails... 871
Pierce-Arrow Assets $13,776,911... 835
Pierce-Arrow Pfd. on 8% Basis... 999
Pierce-Arrow's New Directors... 956
Pierce-Arrow Motor Car Corp. Formed... 785
Pilgrim Motor Co. Formed in Maine... 686
Plank Shaft Co. to Enlarge... 735
Plath to Handle Harroun Sales... 511
Plymouth Castings Doubles Plant... 250
Polack Truck Tire Corp. Formed... 648
Pollock Home from War... 203
Pontiac, $50,000,000 Business for... 910
Pontiac Tractor Co. Formed... 1080
Portage Capital $3,000,000... 120
Portage Rubber Raises Dividend... 504
Porter Rubber Doubles Capital... 957
Porter Is King Asst. Sales Mgr... 471
Post Office Fraud Order Against I. A. L... 1077
Post Tire Buys Plant... 952
Post Tire Co. with $1,500,000 Capital, Formed 250
Prescott a Stutz Director... 168
Price Open Valve in Co-operation... 501
Prina a Pathfinder Rep... 203
Premier Raises Car Prices... 950
Precision Die Casting Merges Two Companies 992
Princess Cars in Production... 647
Princess Motor Corp. Now... 1037
Production, 754,902 Cars in First Six Months of 1916... 88
Publicity, Bans Newspaper... 992
Pulcher Heads New Detroit Club... 598
Pullman Dealers in Convention... 208
Pullman Advances Car Price $85... 685
Pullman Leases Sphinx Plant... 646
Pullmore Motor Truck Co. Formed... 833
Punctureless Tire to Increase Capital... 732
Pyrene to Increase Capital... 1039
Race Gillette Tire Sales Mgr... 908
Racine Tire Branch Managers Meet... 791
Racine Tire's New Plant... 734
Rahan to Make Ford Starters... 996
Ramsden Is Oakland Branch Mgr... 633
Raybestos Incorporates for $1,500,000... 684
Raybestos Brake Lining Survives 1500 Deg. Test... 373
Reddin Increases Capital to $500,000... 374
Redden Truck to Expand... 337
Regal Prices Increased... 1076
Regal, 10,000 for 1917... 827
Reliance Engineering Acquires Hercules Forge 117
Remy Plant, Welfare Work at... 731
Renfro Sparks-Withington Sales Agent... 1042
Reo Drives 70% of Car... 952
Reo Earnings Total $4,031,070... 950
Reo Employees Co-operate to Reduce Cost of Living... 1038
Reo Makes Additions to Factory... 913
Reo Buys Out National Coil... 47
Reo Dealer Pays Customer for Parts... 334
Reo Officers Re-elected... 1035
Reo Six Price $100 Lower... 211
Reo Production, 26,304 in Year... 556
Reo Truck and Car Combine... 426
Reo Working Force Is 5000... 1077
Repair Plant for U. S. Army Trucks... 3
Republic Motor Truck Expanding... 287
Republic Rubber Adds Capital... 649
Republic Truck Shipments Gain... 787
Republic Truck Co. Adds $1,000,000 to Its Capital... 40
Republic Truck Expands... 343
Republic Truck Has Bonus System... 251
Republic Workers Have Co-operative Store.. 1038
Reynolds, of Studebaker, Dead... 1076
Rich Tool in M. & A. M... 287
Richardson Chalmers Adv. Mgr... 955
Rickenbacher Sails for Europe... 1000
Ricker Heads Ricker Oil Co... 787
Riker Prices to be Higher... 909
Riker Trucks Beat Mules... 526
Rio Brazil's Business Center... 371
Rittman Gasoline 6.9 Cents Per Gal... 374
Roads Built Under Federal Supervision... 958
Roads, $16,213,387 in Fees for... 39
Roamer Price Increased $50... 511
Ross Reorganization... 994
Rosenberg Is M. & S. Engineer... 512
Rochette Sails for S. A... 787
Ross Prices Raised $200... 288
Rubber, Guayule, to be Boomed... 250
Rubber Men on Outing... 165
Rubber Products Capital $500,000... 383
Rumely to Make All-Steel Tractor... 588
Runyan Cushion Wheel Co. Formed... 689
Ruse Dies... 470
Rush Motor Truck Co. Formed... 375
Russell Resigns from Bessemer... 503
Ryan Heads Gibson Branches... 504
Safety First Federation Appoints Bureau of Standards on Devices... 550
Salesmanship Club of New York... 690
S. G. V. Creditors to Meet... 831
S. R. B. Creditors Ask for Sale... 829
St. Paul Security Co. to Finance Dealers... 791
Salisbury Wheel Doubles Capital... 205
Sansdale Leaves Denby Truck... 993
Sattley Is Standard-Detroit Mgr... 684
Saxon Bonus for Employees... 338
Saxon, New Plant for... 828
Saxon Plant Damaged by Fire... 870
Saxon New York Factory Burned... 594
Saxon, 60,000 for 1917... 338
Saxon Stock Placed on 7% Basis... 469
Saxon Stock on 'Change... 505
Saxon to Build New Plant... 383
Saxons, 25,399 Shipped in Year... 78
Schaaf with Fisher Tractor Interests... 906
Schmid-Lyon Taken Over... 1038
Schoeneck to Make One Chassis... 906
Schulz Is Mercer Chief Engineer... 728
Schwarz Wheel to Expand... 25
Scripps-Booth Elects Directors... 505
Scripps-Booth Corp. Organized Under New York Laws... 203
Seagrave Finishes Addition... 382
Seagrave Finished Addition... 382
Sealand Resigns from Winton... 164
Selden Truck Advances Dunny... 869
Selden Truck Sales Gain 258%... 650
Sewell Cushion Increases 300%... 162
Sewell Cushion Wheel Co. Adds... 372
Shaler Acquires Vulcanizer Patents... 1038
Shilling Automobile Bumper Co. Formed... 637
Shipments, $10,000,000 in Cars Held Up... 952
Shipment, August, 18,254 Carloads... 381
Shipment, September, 21,660 Carloads... 556
Shipment, November, 17,250 Carloads... 951
Shipment, October, 19,500 Carloads... 729
Selden Division Managers in Conference... 791
Ship, Car Makers Unable to... 911
Shipments, Jnoa, 23,879... 88
Shipment, Ten Day Removal Given... 911
Signal-Commerce Merger... 47
Signal-Commerce Merger Completed... 168
Signal-Commerce Truck Merger Abandoned.. 470
Silver Takes Dort in New York... 594
Silvex Offices to So. Bethlehem... 547
Simplex Capital Now $9,000,000... 1039

Simplex in Aircraft Merger 246
Simplex to Market Its Cars Direct to New York 256
Skinner a Mfr. Rep. 506
Smith Form-A-Truck Takes License Under Look Patent 556
Smith Blair Truck Sales Mgr 908
Smith, A. O., Raises Wages 10% 995
Smith, G. H., Mercer Sales Manager 118
Smith, Paul, Dies from Fall 87
Smalley Is Bound Brook Bearing V.-P. 727
Smith, A. O., Corp. Formed 829
Smith, A. O., Corp. Formed 727
Smith Form-a-Truck Sold 827
Smith Resigns from Chalmers 78
Smith Form-a-Truck Refinancing 874
Smith to Manage Buda Motor Sales 203
Smith Truck Elects Directors 996
Smith Truck-Forming Attachment for All Cars 908
Soldiers to Build Roads, Returned 506
South America Wants American Cars 117
South Is Buying More Cars 998
Southwest Car Sales Show 50% Gain 250
Sparks-Withington Cleveland Branch 1042
Sparks-Withington Dividend 548
Speedway Men Meet Sept. 29 506
Specialty Mfg. Co. Formed 917
Spicer Mfg. Co. Reorganized 511
Splitdorf, Henry, Dead 643
Spohn Leaves Class Journal 1081
Springfield Body Orders Increase 1000% 371
Sproat Is Olds Works Mgr 684
S. S. E. Co. to Build 459
Standard 8 $100 Higher 1035
Standard Oil Reduction—Independents Meet 457
Standard Parts Co. Formed 869
Standard Parts Co. Merges Names 641
Standard Roller Bearing Co. Receiver's Petition, Court Refuses 551
Standard Service Policy in Canada 693
Standard Tractor to Move 831
Standard Welding Makes Promotions 556
Standard Welding Shareholders 835
Standard Traffic Code Distributed 457
Standard Roller Earnings Halt Reorganization 793
Standard Motor Parts Buys Newcastle Co. 685
Standard Parts to Expand 1034
Standard Parts Stock Issue 914
Stanley Is Brisco Assistant Sales Manager 599
Stanley Steamer Prices Advanced 1035
Star Rubber Co. Reorganized 546
Star Motor to Build Automobiles and Trucks 383
Star Rubber to Make Tires 996
Steel Companies Pay Off $4,000,000 1040
Steel Tube Products Co. Formed 686
Steel Prices to Be Steady 688
Steele Succeeds Barber 1079
Steenstrup with General Motors Export 827
Stephens Plant at Full Capacity 373
Sterns Tire, $250,000 plant for 372
Stern-Wear Tubes on Market Dec. 1 917
Sterns Tire of Canada Formed 871
Stetson Motor Car Co. Formed 994
Stewart-Warner Adds 631
Stewart-Warner Earns $604,939 in Quarter Ending Sept. 30 689
Stewart-Warner Buys U-Ray 167
Stewart-Warner Expands Plant 246
Stewart-Warner Statement 162
St. Louis Dealers Open Week 631
Stockbridge Heads N. E. Winton 503
Stout Is Packard Aircraft Manager 908
Stout Plans Aeroplane Clubs 953
Street Railways Use Motor Buses 376
Stromberg Under New Control 125
Studebaker Plans 200,000-Car Output 953
Studebaker Conference 914
Studebaker to Enlarge Forge Shops in Detroit 35% 547
Studebaker Dealers' Convention 42
Studebaker Earns $6,028,329 168
Studebaker to Add 40,000 ft. 203
Studebakers in 8 Months 48,750 469
Studebaker, Canadian Co. Builds 48,750 729
Steinmetz's Electric to Be Built 785
Studebaker Earns $8,140,420 792
Studebaker, Two 1917 Chasses 909
Studebaker Occupies New Texas Building 693
Studebaker Plans Expansion 456
Studebaker's Vast Expansion 630
Stutz New Roadster 204
Stutz & Saxon on 'Change 505
Stutz, 16-valve Roadster Ready 335
S. K. F. Controls Hess-Bright 787
Sun to Market Single Chassis 869
Sulzberger Changes Name to Wilson 127
Sweden Has Only 9000 Cars 1078
Sweet Leaves M. & A. M. for U. M. 513
Swift an Overland Director 909
Swinehart Recalled to Republic Plant 208
Swinehart Tire Business Increases 20% 590
Swindlers, Arrested as Tire 508
Swiss Magneto Moves to Monroe 917
Taber with Asbestos Protected Metal Co. 204
Tamish Mitchell Sales Manager 511
Tanks for U. S. Army 997
Tax Case Heard by Supreme Court 788
Taxicab, N. Y. Rates to Be Cut 80
Taylor Joins Evapco Co. 503
Taylor, S. K. F., V.-P. 1035
Tay-Miller Increases Capital 204
Teeter-Hartley Doubles Capacity 373
Templars Motor Corp. Formed 792
Tener Maxwell Sales Director 951
Texas Business Good 634
Texas Crops Promise Prosperous Year 290
Texas Co. Offers New Stock 549
Theft Insurance Rates Raised 508
Thianna Car Now on Market 256
Thompson Overland Advertising Director 642
Times Sq. Motor Supply Co. Formed 501
Time Payment Plan for Trucks 789
Timken Buys Out David Brown 299
Timken Co-operative Store 953
Timken Employees to Own Store 837
Tire Prices to Be Raised 15 to 20% 993
Tisch to Make Dean Knife Timers 643
Tireoid Directors Announced 80
Tires, Exporting Standard 533
Tobin with Cutting, Armstrong & Smith 503
Toledo-Findlay Tire Directors Elected 546
Toledo Plants Are Rushed 831
Tompkins in Ward Leonard 557
Toronto Tire Plant 734
Torbenson Axle Co. Formed 382
Torbenson Axle Elects Officers 512
Torbenson Buys Land and Adds 246
Tractor Demonstration, 100,000 at 160
Tractor Design, Fascination 348
Tractors, Illinois Farmers Want 343
Tractor Ratings Committee Appointed 160
Tractors, 5000 for Texas 87
Tractors Make Hit in Kansas 169
Tractor Tested, Light Four 502
Tractor Tests, 200,000 May Watch 79
Trade-Mark Registration Law 45
Trailers, Milwaukee Forbids Use of 289
Travers Nash Add. Mgr 955
Trenton Plants Being Enlarged 338
Troy Mfg. Co. Buys Studebaker Bldg 686
Troy Trailer Sales Co. Formed 994
Truck Wheel Corp. Formed 875
Truck Makers Draw Together 459
Truck Requirements to Be Defined by War Department 202
Trumbull S. K. F. Advertising Manager 959
Turnbull Wagon Adds Bodies 953
Tucson, Stutz Wins 737
Twin City Motor Speedway, Ask New Receiver for 550
Union Products Formed 590
Union Truck Elects Officers 204
United Motors Buys Klaxon 425
United Motors Buys Houk Co. 786
United Motors Adds Radiator Co. 727
United Motors Raises Capital 1040
United Motors Ramifications 293
United Motors Truck Co. Formed 642
U. S. Wheel Corp. is Organized 913
United States Orders $3,500,000 Worth of Trucks 45
United States Truck Shows Increase 1075
United States Tests Armored Truck 203
United States, 2400 Cars and Trucks for 5
United States Advocates System 334
U. S. L. Directors Elected 420
United States Truck Capital $1,000,000 343
United Takes Over Fairbanks Hammer 997
Universal Heater Co. Formed 1084
Vail Rubber Name Changed 837
Vail Tractor Sells at $500 588
Van Dorn Tool Doubles 502
Velie Production Increased 300% 647
Velie Price Changed 909
Velie Companies Merge 868
Velie Companies May Consolidate 786
Velie Represented in Australia 508
Velie Improvements 119
Ver Linden Olds Pres 828
Victor Buys Jenkintown Factory 1080
Victor Motor to Build Automobiles Near Wilmington 383
Victor Motor in New Plant 917
Victor Rubber Capital $750,000 208
Vincent Wheel in New Location 910
U-Ray Plug Now Being Made 287
Ver Linden is Olds Manager 165
Wade Is Buick Purchasing Agent 246
Wahlberg Joins Nash Motors 256
Wagon Makers to Merge and Build Motor Vehicles 731
Waldon Resigns from Cadillac 125
Walker Becomes a Chandler Engineer 127
War, Federal Trade Commission, Analyzes After-Conditions 991
Ward Leonard Patent Licensees 724
Warner Cuts Capital 1040
Warner Is Oakland President 555
Warner Adds Heavy-Duty Trailers 250
Watkin Wright Roller Sales Manager 78
Watson Asst. to Haynes 427
Watts Joins Republic Rubber 830
Waukesha Motor Promotes Industrial Education 790
Waukesha Motor to Expand 502
Waupun Builds Bodies 631
Wayne Oil Increases Capital $200,000 163
Weatherproof Body Reorganization Takes Over Wilson 169
Weaver Returns to Timken Axle 598
Webster Heads Racine Rubber 597
Webster, Gramm Truck Man, Dies 735
Weed, Chain Maker, Plans Capital Increase of $6,000,000 992
Weed Hal Advertising Manager 994
Weidely Capital Now $600,000 684
Westgard to Build Tires 334
Westinghouse, A.B.C., Starter Contract 916
Westinghouse Employees' Bonus 915
Weston Leaves U. S. Tire to Join Mitchell Motors 416
Western Motor Appliance Moves 1077
Weston Stays with U. S. Tire 590
Wheel Tax for Minnesota 691
Wheel Tax in Cleveland $2 547
White Detroit Battery Sales Mgr 917
White Co. to Erect Addition 426
White Moves in New York 378
White Empire Purchasing Agent 728
White Star Refining, Taylor with 869
White Stock on 8% Basis 835
White Surplus Is $1,623,521 684
White Sued for $1,500,000 591
Whitman National Production Engineer 827
Wilson Adds 1-Ton Model 908
Wilson Tire Reorganization Planned 834
Wichita Falls Plans to Expand 163
Willard Battery Business Increasing 256
Willard Completes New Building 647
Williams Aeroplane Factory Remodeled 912
Williams Goes to Antipodes 1079
Willard to Erect New Building 1038
Willis Is Hal V.-P. 997
Willis Is U. S. Rubber Purchasing Agent 372
Willys Addresses Insurance Presidents 1039
Willys-Overland Capacity for 1917 Is 300,000 425
Willys-Overland Increases Wages 995
Winton $200 Increase 950
Wilson, of Redden, Gets Michigan 633
Wilson Takes Over Sales Duties 642
Wiltrout Joins Crow-Elkhart 810
Winckler with Pittsburgh Engine 785
Winningham Hudson Add Mgr 291
Winther Truck Elects Officers 1041
Winther Motor Truck Co. Formed 830
Winton, 4000 for 1917 598
Winton Chauffeurs Get Prizes 956
Winton Offers $1,500,000 Preferred 555
Wisconsin Trucks in Production 590
Wizard Parts Co. Formed 503
Woodruff Is Simplex Asst. Sales Mgr 471
Woodruff Is Simplex Sales Mgr 647
Woodruff Is Simplex Asst. Sales Mgr 471
Woodard's Sale Duties by Paul and Rittenhouse 868
Woodward President of Gillette Tire 868
Woodard Resigns from N. J. Car Spring 786
Wooler Designing Light Six 383
World's Salesmanship Congress Story 67
Wright Is Cassidy Special Rep 590
Wright-Martin Capital $5,000,000 548
Wright Patent Threatens Aviation Industry 1033
Young Is Dort Experimental Engineer 515
Youngstown Co. to Add 833
Ypsilanti Motor Truck Co. Formed 788
Zimmerman Joins Milwaukee Engine Co. 382
Ziola Carbureter Sells Out 126

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22-73 RACEABOUT

When an insignificant little bronze bushing wears out—

It causes rattles or knocks, vibrations or lost power and invariably results in expensive overhauling and temporary loss of the car.

Any repairman who replaces worn bushings with bushings of ordinary bronze runs the risk of causing the owner an amazing amount of trouble and expense.

The choice of a proper bearing metal for bushings may seem, at first glance, to be a matter of small importance, but when you consider the expensive and disastrous results that may follow through the use of bushings of questionable or unproven merit, then the matter assumes vital and paramount importance, both as concerns the owner's pocketbook and the repairman's reputation.

If you have reason to believe that your repairman is both experienced and conscientious, you can safely depend upon him to overhaul your car with bushings made of highest grade bronze.

But if you have any reason to believe that he does not regard the bushing problem as serious, then, for the sake of your pocketbook and your future peace of mind, insist upon him using Non-Gran.

By so doing you will save hundreds of dollars in future repair bills because your car will be equipped with the same flawless, long wearing bushings that enable quality-built cars to deliver from two to five times the service of ordinary cars.

Non-Gran differs radically from all other bearing bronzes.

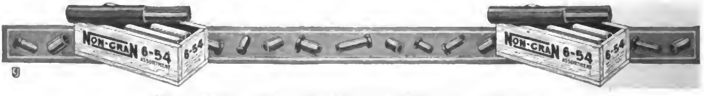
Non-Gran excels any known metal used for bushings in its combination of wear-resisting qualities, toughness, unfailing uniformity, molecular cohesion and freedom from flaws.

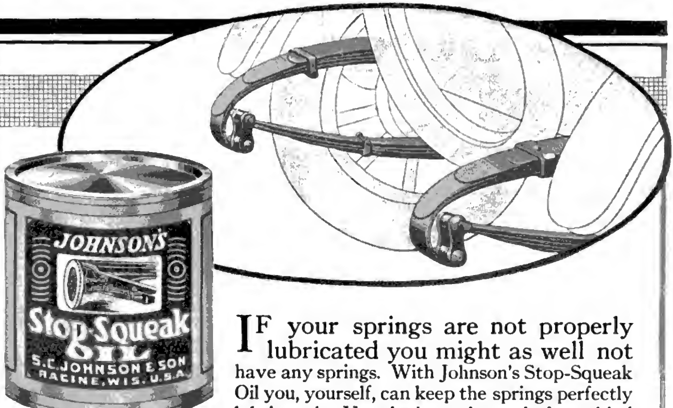
Practically all manufacturers of high-grade cars and motors make their bushings of Non-Gran.

These men know that a car can last only as long as its wear-subjected, non-adjustable bushings. Consequently, they take no chances but use the best metal they can get—Non-Gran.

American Bronze Company
Berwyn - - - Pennsylvania

HIGH SPEED
NON-GRAN
BEARING BRONZE





IF your springs are not properly lubricated you might as well not have any springs. With Johnson's Stop-Squeak Oil you, yourself, can keep the springs perfectly lubricated. You don't need a tool of any kind—you won't even need to jack up the car.

The springs of every car should be given an application of Johnson's Stop-Squeak Oil once a month. It penetrates between the leaves of the spring removing all rust and depositing a thin layer of grease between each leaf from end to end.

You can easily demonstrate the penetrating power of Johnson's Stop-Squeak Oil by applying it to the side of the springs and watching it come out on the other side, driving the rust before it and leaving a thin layer of grease between each leaf.

JOHNSON'S STOP-SQUEAK OIL

Has the remarkable property of seeping rapidly between the spring leaves and to the furthermost wearing points and it there becomes a heavy-bodied lubricant. It is unexcelled for removing squeaks of all kinds—in **springs, shackle bolts, body, fenders, top,** etc. Just locate the squeak and touch it with Johnson's Stop-Squeak Oil.

Makes Your Car Ride Easily

Johnson's Stop-Squeak Oil is a simple remedy for hard riding cars. Instead of bumping over the road, you can fairly float along if your springs are lubricated so that you get spring action. If the leaves of a spring are rusted together you might as well have a solid piece of steel as a spring. Johnson's Stop-Squeak Oil reduces the liability of spring breakage.

If your dealer cannot supply you with Johnson's Stop-Squeak Oil, fill out the enclosed coupon and we will fill your order direct from Racine by prepaid express. Please give us the name of your dealer.

S. C. JOHNSON & SON
Dept. A
RACINE, WIS.

S. C. JOHNSON & SON, Dept. A Racine, Wis.
Enclosed please find $1.00 for which please send me by prepaid express a quart of Johnson's Stop-Squeak Oil.

NAME..

ADDRESS..

CITY & STATE..

MY DEALER IS..

The passing of each year has marked a broad step forward in the advancement of the automobile industry. Old ideas have been swept aside giving place to new, and equipment once standard has been replaced by that of entirely different design.

In the face of such conditions the fact that no changes in the basic principles of construction or design of Columbia Axles have been necessary or desirable is strong evidence that they have been built right from the start. Minor refinements from time to time have kept them over abreast of modern day demands. And today "Columbia Axles" are accepted as representing the highest standard in automobile axle construction.

Columbia Axles are built by Axle Specialists. A modern, fully equipped factory is devoted to their manufacture; and each workman whose efforts contribute to their production is highly trained in the performance of his particular task.

A booklet clearly describing the making of Columbia Axles will be mailed on request. Write us today.

THE COLUMBIA AXLE CO.
CLEVELAND, OHIO

STAR
HAND-MADE
TIRES

Are You Ready To *Control* the Sale in Your Territory!

The successful tire merchant of tomorrow must absolutely control in his territory the selling of the goods he offers and be in a position to make a profit consistent with his efforts. The margin of profit now received from the quantity tire manufacturer does not exceed the overhead expenses of a well conducted distributing agency and he finds himself simply swapping dollars with the manufacturer. More and more service is being demanded by the tire buyer and in order to extend this necessary service the dealer must receive a larger margin of profit.

During 1917 it is estimated that over $350,000,000 will be spent in the purchase of tires for pleasure cars alone. It will be the golden opportunity for the beginning of a permanent business with continuous profit for tire dealers who sell the right tire at the right price and with a substantial net profit. Our organization has established a fixed policy for selling its entire output through

Exclusive Dealers

There will be no branches and we offer a most unusual proposition for the dealers who become associated with us for putting unlimited effort behind their sales—receiving in return absolute territorial protection.

The **"ALL STAR"** tread (and its kindred styles) promises to be a sensation in the tire field and will be produced by Akron's most experienced capital, its best manufacturing brains and by the most expert labor born of years service in the perfection of tire making.

If you are ready to accept this exclusive agency for the newest Star in tiredom, write us immediately. We pledge you the most liberal proposition ever made to tire dealers; we pledge the men who buy a better tire—a value received in full; and the most perfect tire that money, brains, material and workmanship can build. The various styles of tires and tubes will be complete and with

5000 MILES GUARANTEED SERVICE

Quick action necessary to secure your territory.

ALL
STAR
TREAD

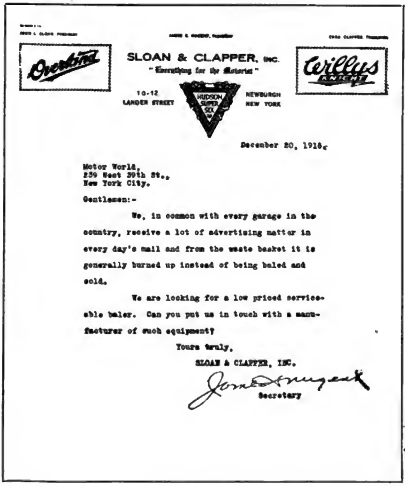
THE STAR RUBBER CO.
HAND-MADE
TIRES
DEPT. 3
AKRON, OHIO

New York Auto Show Exhibit—Hotel Astor
Chicago Auto Show Exhibit—Auditorium Hotel
In personal charge of O. L. Weaver, Secretary

What Constitutes 100 Per Cent Business Success?

(1)	To produce an article that is salable	40%
(2)	To organize channels for selling and distribution	25
(3)	To create demand that will absorb the product, with a fair percentage of profit for the manufacturer	35
		100%

The advertising man represents 35% in the success of every business. Greatest success in the car and accessory industry is where the advertising man lives up to the limit of his possibilities—where he measures up to the full 35%.



Overland

SLOAN & CLAPPER, INC.
"Everything for the Motorist"

Willys Knight

10-12
LANDER STREET

Hudson Super Six

NEWBURGH
NEW YORK

December 20, 1916.

Motor World,
239 West 39th St.,
New York City.

Gentlemen:-

We, in common with every garage in the country, receive a lot of advertising matter in every day's mail and from the waste basket it is generally burned up instead of being baled and sold.

We are looking for a low priced serviceable baler. Can you put us in touch with a manufacturer of such equipment?

Yours truly,
SLOAN & CLAPPER, INC.
Secretary

The advertising man has two major responsibilities: (1) to prepare forceful and impelling "copy," and (2) to present that copy to potential purchasers in such manner as will insure direct interest in the product advertised by those to whom the copy appeal is directed.

The reproduced letter on this page bears a significant message to those advertising men who are anxious to become 35 per centers. It proves the unwisdom of contributing to that seemingly inexhaustible flood that goes over the desks and into the waste baskets in thousands of establishments in every section of the country.

Let Us Suggest a Little Demonstration

Next time you "cover your mail list" with a particularly good circular go to a half dozen dealers, garage owners or consumers (as the case may be) about three days after the circular reached them via mail. Ask each of that half dozen if the circular got to his attention, and if so what was the impression created? Note how many of that half dozen reached the "baler" stage without even having been looked at.

What does it cost per thousand to cover your mail list with, let us say, a 9 x 12 circular, on 100 pound coated stock, printed on one side, in one color, folded and sent out in a No. 10 envelope under one cent postage? Paper, composition, presswork, etc., are expensive right now, and your figure will be somewhere around $22.25 per thousand.

If your list, let us say, is 65,000, the total cost will be $1,446.25 net.

The combined circulation of The Automobile, Motor World and Motor Age is in excess of 65,000 and is made up of the most influential industrial and trade representatives and consumers.

An advertising page (size 9 x 12) in the THREE papers, at the one time rate, is $275. This buys more than 65,000 circulation in the industry's three leading papers. The cost is only $4.23 per thousand.

But there is a greater advantage than the difference between $22.25 and $4.23, or between $1,446.25 and $275. It is this: In the first instance you are sending good advertising matter to people who have expressed no desire to get it and, who, in consequence, will disregard and discount it; and, in the second instance, your merchandise message is presented in three papers of undisputed editorial worth—papers that are subscribed for, paid for and **read** by the exact classes of people depended upon to absorb your product to the profitable advantage of those who are the owners of the capital stock of your corporation.

The advertising rate cards, circulation statements, etc., of The Automobile, Motor World and Motor Age will be sent upon request

Address
THE CLASS JOURNAL COMPANY
Publishers
239 West 39th Street New York City

THE NATIONAL AUTO SHOWS

Under Auspices of National Automobile Chamber of Commerce, Inc.

At NEW YORK
Grand Central
PALACE
January 6 to 13

At CHICAGO
Coliseum and 1st Regiment Armory
January 27 to February 3

Passenger Vehicles—Parts
Accessories

S. A. MILES, Manager **7 East 42nd Street, New York City**

The Usual Courtesies to Visiting Dealers

And now that we have given you the more important facts about the AMERICAN SIX, let us tell you something of the Sales Policy behind it

LIKE the car itself, the sales policy behind the AMERICAN SIX has been carefully developed by men of experience who are using all the lessons of the past to provide the largest and most permanent satisfaction for the future. Three cardinal principles will dominate the selling policy of the AMERICAN SIX.

FIRST—*To build up a real Merchandising organization*—an organization of automobile merchants who recognize opportunity, know possibilities, and look to the future not less than the present. In the AMERICAN SIX Dealer-organization the man counts most. Ample capital and complete sales arrangements have their places in our estimation but they are secondary to the integrity and intelligence of the man.

SECOND—*To create a permanent organization. From the* profit standpoint permanence is as vital to you as it is to us. We are building an organization for tomorrow as well as today, and we want our Dealers to share in all the future profits to be derived from the increased sales and production of the AMERICAN SIX. We will stand by our Dealers.

AND FINALLY—*We propose to co-operate with our sales organization to the best of our ability.* We recognize that the Dealer is the best judge of sales conditions in his territory and therefore we cannot do his selling. But, in-so-far as we can, we will lend our aid and co-operation in service and merchandising. To this end an extensive advertising campaign in the *Saturday Evening Post* and other influential national publications is already under way, and by every other effective means this Company is pledged to put its full resources behind its Dealers.

New York Show
4th Floor D1 & D2

Chicago Show
Greer Building G12

To a Limited Number **of automobile merchants whose ideas harmonize with ours and who see in the AMERICAN SIX a permanent and profitable opportunity we are now ready to offer a contract for its sales representation.**

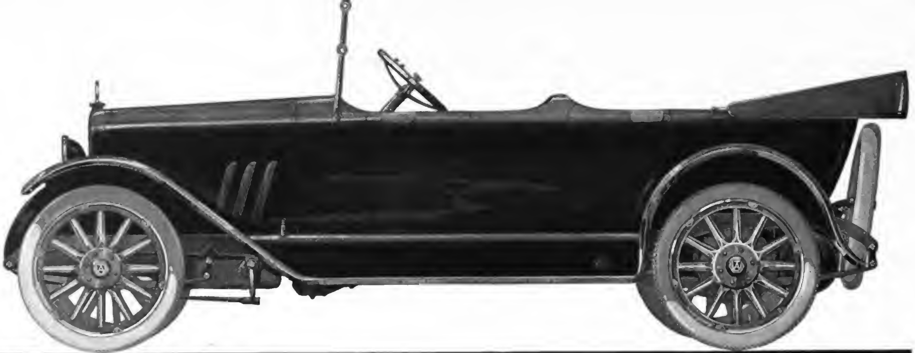
We will build only 3000 cars this season. You may have your share of this total—provided you act promptly. Applications for territory will be considered in the order of their receipt.

Production of the AMERICAN SIX is so far advanced that we can assure deliveries in quantity by January—demonstrators immediately.

The AMERICAN SIX will be displayed at the New York and Chicago Automobile Shows. Reservations of Territory may be entered now.

A Car to Compare with Costlier Cars

AMERICAN SIX $1285



A Car to Compare with Costlier Cars

AMERICAN SIX

IN THESE DAYS almost any automobile manufacturing concern can sell its *first year's* output. The real test comes in the *second* year. If the car is right, if its performance measures up to its promise, other things being equal, it will have a *good* second year—and just as likely many better years to come. But if it doesn't meet the test, look out for trouble. *The AMERICAN SIX is built for the Second Year.* Looking at it, you say "This is a *fine*-looking car." But there is more to it than looks. Down inside, where the wear and tear comes, it is built right. Mechanically and structurally, it is as good as it looks.

And the *Reason* is this: The AMERICAN SIX was planned and is built by *men who know;* there has been no guess work in its development. Behind it is an organization of engineering and manufacturing experts whose skill and ability are known and recognized wherever automobiles are made. This is a sure guaranty that the AMERICAN SIX is not only a good-looking car but is also a *perfect mechanism,* smooth running and efficient in operation.

And it is to this fact that we look for *bigger* sales the SECOND year and in all the years thereafter.

A car is only as good as its engine

The AMERICAN SIX power plant is a revelation of efficiency. The motor block casting—suspended at three points—is designed for even cooling of *all* parts of the cylinder walls by having water surrounding each piston pocket. The 1 9/16 inches valves are a size usually found only in far larger motors, and the valve seats are so thoroughly water-cooled that pitting is made impossible. The 1¾ inches crank-shaft revolves on three wide plain bearings. The circulating splash type lubrication is certain and positive. Oil is easily put into the engine base through the accessible breather top. The water-pump, distributor generator and tire pump are driven by one shaft. To assure lightness the upper portion of the motor casting is aluminum and the base pressed steel. The bore is 3 inches, the stroke 5 inches. Heated air enters the Zenith carburetor and the vaporized fuel is sent directly into a manifold integral with the engine block. In operation this powerful and efficient motor, built under the immediate direction of the engineers of the American Motors Corporation, is quiet and smooth running, flexible and economical in the consumption of gas. It puts the AMERICAN SIX in a class by itself.

Brief Particulars of the AMERICAN SIX

EQUIPMENT:—Engine-driven tire pump; Boyce motometer; one-man top, quick detachable curtains; rain-vision windshield; dash lamp lighting speedometer, ammeter, carburetor adjustment, lighting and ignition switches; starter button on toe-board; button of motor-driven horn at steering wheel center; complete set of tools.

GASOLINE SYSTEM:—Tank at rear and Carter gravity tank over engine.

RADIATOR:—Cellular, shallow but high and broad.

IGNITION:—Generator-storage battery, Gray & Davis coil and distributor.

ELECTRICAL SYSTEM:—Gray & Davis two-unit, starting motor has Bendix drive to fly wheel, generator on pump shaft, 6-volt, 100 ampere hour Willard battery; double bulb headlights, wiring of one-wire type.

CLUTCH:—Three dry-plate discs, ball bearing throw-out collar.

TRANSMISSION:—Selective sliding gears, three speeds and reverse.

AXLES:—Front, one-piece drop forged I-beam; rear, three-quarter floating, spiral bevel gears, gear ratio, 4 5/12 to 1.

WHEELS:—32" with 4" straight side tires on demountable rims, extra rim in tire carrier at rear.

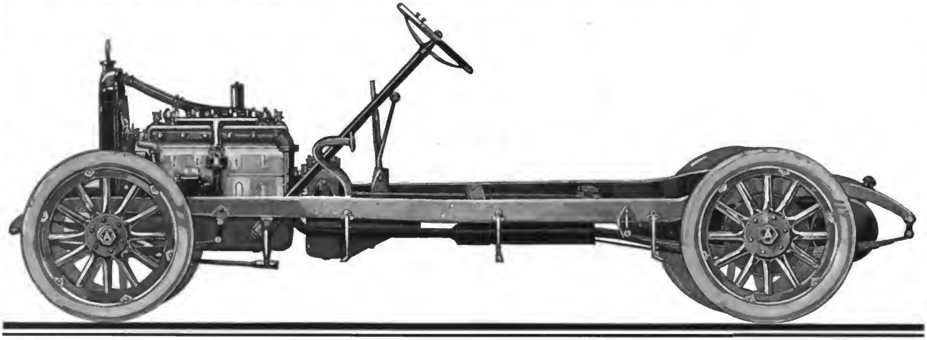
WHEELBASE:—122"; tread 56".

BRAKES:—On rear wheels; hand emergency expanding, foot service contracting, drum 14" diameter, 2½" wide.

SPRINGS:—Semi-elliptic, front 38" x 2", rear 52" x 2", Hotchkiss drive.

CONTROL:—Left drive, center control.

WEIGHT:—Car and equipment, 2700 pounds distributed equally front and rear.



WHEN you are going into business with other men it is a good plan to know who they are. These three men are a big part of the organization that builds and sells the AMERICAN SIX. There are other good men in the American Motors Corporation but, first of all, you will want to know Speirs, Chevrolet and Brock

PRODUCER

JOHN C. SPEIRS, General Manager and Construction Engineer, is recognized in the automobile industry as "a man who makes a reality out of visions." He is a practical plant executive of vast and diversified experience without a superior—and mighty few equals—in the entire motor vehicle field. Speirs knows thoroughly every best method of making an automobile that gives service and lasts long. From the inception of automobile building in this country he has been directing the work of men and building the materials that went into the making of good cars—Locomobiles, Autocars, S. G. V's and Mercers—and his ripe experience is entirely at the command of the AMERICAN SIX. Speirs is in direct charge of the factory and all matters of production.

ENGINEER

LOUIS CHEVROLET, Vice-President and Chief Engineer, is widely known as an automobile expert and engineer. His technical knowledge and training have been enriched in that severest laboratory of automobile engineering—the racing course, where he won his early fame. He is the holder of many famous trophies, having finished in first place ten times out of twenty-five starts in national road races since 1909. In the course of this experience Chevrolet has racked automobiles over rough roads and smooth, to the tops of mountain peaks, and at breath-taking speed over all sorts and conditions of speedways and dirt tracks and, although his personal interest is largely confined to automobile construction, even now he occasionally takes his place at the wheel in important racing events.

MERCHANDISER

MARCUS I. BROCK, Director of Sales, is one of the business veterans of the great—although young—automobile industry in this country. He had charge of the sales department of the Autocar Company in the earliest days of motoring in America. He also performed a similar service for the E. R. Thomas Company and for some time was Assistant General Manager of the Association of Licensed Automobile Manufacturers. Brock is known to the trade as a builder of dealer organization—not as a driver—in his relations with merchants who have been agents for the cars he was selling. And in his present capacity he is welding together a permanent selling organization of automobile merchants who look to the AMERICAN SIX for fair dealing and substantial profits now and in the future.

To Dealers

AS stated on the first page of this announcement, applications for the limited territory to be allotted for the AMERICAN SIX are now being considered. You will have ample opportunity to see the AMERICAN SIX at the NEW YORK and CHICAGO AUTOMOBILE SHOWS, but reservations of territory may be entered now. Address all communications to MARCUS I. BROCK, Director of Sales

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AMERICAN MOTORS CORPORATION

Executive Offices: 141 Broadway New York

LOUIS CHEVROLET, *Vice-President and Chief Engineer* JOHN C. SPEIRS, *General Manager*
MARCUS I. BROCK, *Director of Sales*
Factory: PLAINFIELD, New Jersey *Sales Offices:* PLAINFIELD *and* NEW YORK

BOCK

Everything Rolls

Here is the only Roller Bearing which carries a *two*-way load, *both* on frictionless rolling contact.

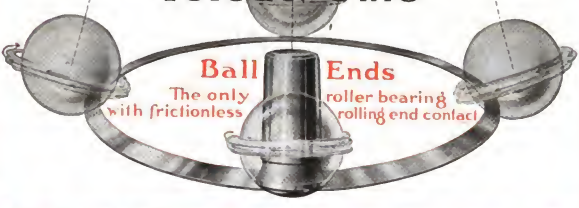
The *end* of each roller is spherical and *rolls* in unison with the tapered rollers.

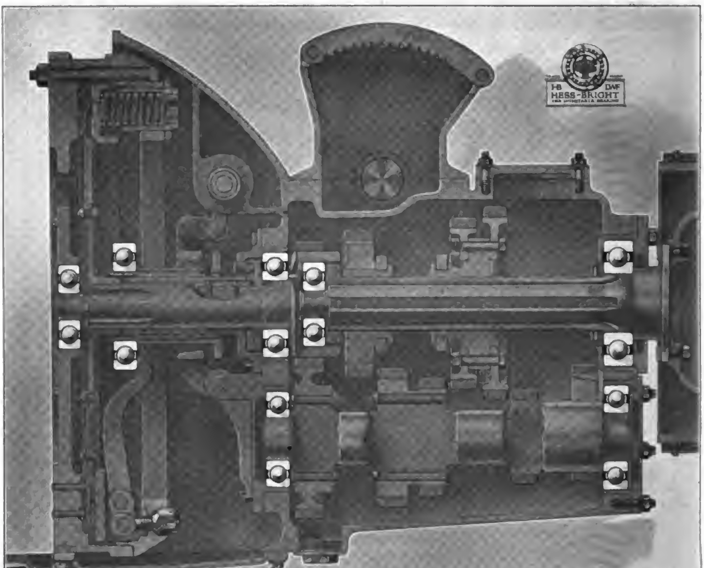
It combines the good features of the ball bearing with the greater load capacity of the roller bearing.

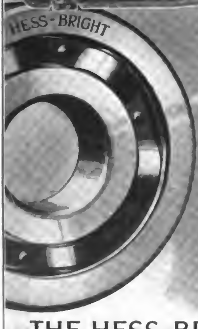
Naturally it will carry much heavier loads and outwear any other roller bearing.

It has the universal preference of engineers and is replacing all other types used in motor cars as fast as we are able to supply sufficient quantities.

The BOCK BEARING Co.
Toledo, Ohio


Ball Ends
The only roller bearing
with frictionless rolling end contact





HESS-BRIGHT BALL BEARINGS

are always the first choice of those motor car manufacturers who aim to use the best, irrespective of first cost.

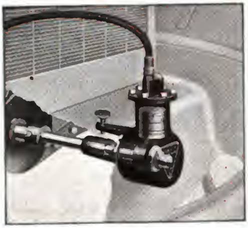
The illustration above is that of a Simplex transmission equipped with HESS-BRIGHT BALL BEARINGS

THE HESS-BRIGHT MANUFACTURING COMPANY
PHILADELPHIA, PA.

HESS-BRIGHT'S CONRAD PATENTS ARE THOROUGHLY ADJUDICATED

An Engineering Standard

See
the
Improved
1917
Model



At
New York
Show
4th Floor
Space D 195

GEARLESS DETROIT MOTOR-DRIVEN TIRE PUMP

Patented August 24, 1915

Crank-Shaft Driven—Carried in Tool Kit On or Off in a Jiffy

A miniature, standard air compressor, built on the same sound engineering principles as the largest and most expensive types.
The simplest, safest and best solution of the tire pump problem. Several leading 1917 models now being designed for it. **Complete blue prints on request** to engineers.

No Tools to Attach It
No Gears to Drive It
No Risk of Overloading Water Pump or Magneto Shaft
Leaves Motor Clean and Unencumbered

Write for Complete Details

$10
Complete

DETROIT ACCESSORIES CORPN.
520 Hillger Ave. Detroit, Mich.

L. J. MUTTY CO
BOSTON
REGISTERED TRADE MARK

Everlastingly Keeping at One Thing Produces Results—

On this principle we have always specialized in just one thing, and that is combining rubber with fabrics.

Together with this specialty we have a hobby, and that hobby is QUALITY.

We produce rubberized fabrics for Automobile Tops, Curtains and Upholstery in several qualities, but our best effort which gratifies our hobby is known by the trade at large as BULL DOG QUALITY.

If you need rubberized fabrics in the manufacture of your products—investigate BULL DOG QUALITY.

Samples and prices on request.

L. J. MUTTY COMPANY, Boston, Mass.

Driving Through Air ~

What Makes the Owen Magnetic Run So Smoothly?

Men who have ridden in Owen Magnetic cars owned by their friends are constantly coming to us asking, "What makes this car FEEL so differently in the way it rides? What makes it FLOAT along the road as though it were being drawn forward by some force outside of itself?"

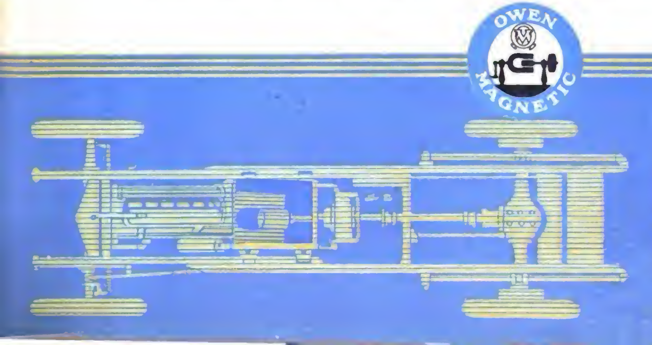
The answer is, because when you ride in an Owen Magnetic, you are driving by magnetism through air space.

Unique Comparisons

By referring to the drawings at the bottom of these pages you will see that we have an explanation of the operation of this transmission as it appealed to a youth of fifteen. Here is shown a magnet mounted on a pedestal that can be revolved by its hand crank. Between the ends of the magnet a piece of steel attached to a shaft is mounted on a similar pedestal.

The Cause of Smooth Action

Now if you turn the hand crank and so revolve the magnet you will find that the piece of steel also revolves, although there is an air space between the steel and the magnet. You will notice that even if you should start the hand crank



Here you see the principle of the Owen Magnetic Transmission reduced to its simplest form. A magnet turning a piece of steel with it, as it responds gradually to its magnetic power.

DRIVING THROUGH AIR

with an abrupt jerk, the piece of steel would not start with a jerk, but will begin to move gradually, starting with an imperceptible gradation of movement—so gentle—so slight—that the eye scarcely can register it. That is because there is no rigid mechanical connection between the magnet and the steel—because the steel is revolved by an invisible, intangible magnetic force flowing across an air space.

The Mission of the Magnet

Now turn again to the illustration at the bottom of the page and you will find instead of a hand crank to revolve the magnet, we have a gasoline engine. Then note that the piece of steel is still between the ends of the magnet, but is now mounted on the drive shaft of the car. Here you will see that the engine revolves the magnet, the magnet revolves the steel, and of course revolves the drive shaft with it—and you will see also that when the magnet revolves, although it may start with a jerk, the piece of steel—and therefore the drive shaft—cannot start with a jerk, but will be gradually, softly drawn around with an imperceptible motion by this elastic magnetic field acting across an air space. You will note that there cannot be a sudden jump in driving effort from engine to drive shaft, to rear wheels, to tires, as when the clutch is let in and a rigid connection made between power plant and rear wheels as in the ordinary type of car.

Owen Magnetic Means Car Longevity

There is just the gentle drawing forward, due to the magnetic force, acting across an air space, which starts the drive shaft revolving and in turn starts the car forward so smoothly that it is actually in motion before the passengers can feel the motion—and its speed accelerates with such a smooth but perfect gradation, that there is no jerk, no jar, to mar its exquisite softness of riding—no harsh impact of power impulse to wear out differentials, axles, their bearings, and also the tires.

Coasting Qualities

Only when the engine is running faster than the propeller shaft is driving effort applied to the wheels. With the throttle closed the engine slows down to its idling speed and the car coasts perfectly free. The power is again applied by merely opening the throttle when the engine will increase its speed until it overtakes the propeller shaft and the magnetic lock again becomes effective.

Delightful Sensation — Safe

The coasting ability of the Owen Magnetic is not only a delightful sensation but is a wonderful aid in driving on slippery roads without the danger of skid-

wen Magnetic Transmission permits
e driver to run his car at any speed
desires, and control his clutch and
rake as well, by simply moving a
er on the steering wheel. This gives
n entirely new form of speed control,
dependent of the spark and throttle.

DRIVING THROUGH AIR

ding. Where there is a positive connection as in the ordinary type of car between engine and driving wheels, the engine upon closing the throttle acts as a brake on slippery roads—the change from driving effort to braking almost invariably means skidding.

In the Owen Magnetic car, closing the throttle does not produce a braking effect—it allows the car to coast perfectly free without driving effort or braking at the wheels. Because of this the danger of skidding on slippery pavements is very much reduced and the car can be driven with greater confidence and a greater sense of security than is true of the ordinary type of car.

Electric Brake

In the neutral position the motor is connected to act as an electric brake—here it becomes a generator, taking power to drive it and so braking the car. It will hold the car on any mountainous grade without wear of any parts. It cannot hold the wheels, thereby practically eliminating skidding. The electric brake holds the car down to an absolutely safe speed on the worst hills. The electric brake is an addition to the regular foot and emergency brakes.

Owen Magnetic Transmission Eliminates

The friction clutch, clutch pedal, transmission gears, fly wheel, separate starting and lighting systems and their clutches, gears, chains, connections and automatic devices are eliminated because the Owen Magnetic system does the work of all.

What It Does for the Engine

It cleans up the power plant, makes it more accessible. Makes all of its parts, such as valves, valve springs, carburetor, magneto, water pump, hose connection, tire pump and steering gear case most accessible.

In the Owen Magnetic Is Offered

ease of control, elasticity of power, constant torque, smooth riding at a thousand speeds—qualities which other manufacturers have sought in vain by multiplying cylinders.

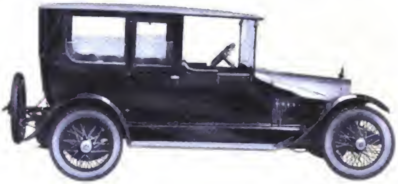
Unparalleled coach work, of the design and quality individual to only the highest priced foreign cars, characterizes the Owen Magnetic.

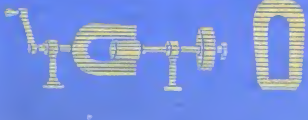
The Wonderful Control

The different controls of a motor car are accomplished on the Owen Magnetic by one small finger lever on the top of the steering wheel. This moves a drum controller to different positions and there can be no interference between any of these positions. You start, stop, increase, diminish or float along at any speed. No jerk nor jars like other cars. Only the smoothest riding action.

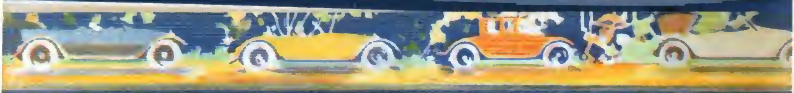
Complications Eliminated

There are no automatic cut-outs, regulators or roller ratchets, no chain or gear drives for any of the parts. Simply two ample sized dynamo machines direct connected and a drum controller, and require practically no





With an ordinary horseshoe magnet mounted as shown, anyone can prove for himself that a wheel with its shaft head placed within the arms of the magnet will turn with the magnet without any actual contact.



DRIVING THROUGH AIR

attention or adjustment. These replace the separate starting and lighting systems with their complicated means of driving and regulation—the friction clutch and its actuating mechanism—and the fly wheel.

Simple and Clean

The system is as simple and clean as it is possible to imagine. It accomplishes more desirable things than have ever before been accomplished with a motor car and with an infinitely less number of parts. Outside the simplicity of the system and the fact that it displaces forever the most complicated and objectionable parts of the prevailing type of motor car, there are many features that appeal to those that drive and ride in an Owen Magnetic car.

Action as Smooth as that from an Electric Motor

All power impulses of the gas engine are eliminated—the turning effort impressed upon the propeller shaft is exactly as uniform and smooth as that from an electric motor. No shocks nor jars can be transmitted through this absolutely elastic means of transmitting power.

Power Never Disconnected

From a standing start to maximum speed through all the range of power required from level road to the worst hill, the power between the engine and the propeller shaft is never disconnected, as is the case where clutch is thrown out, a gear change made and clutch engaged again. The car may be easily manipulated in traffic, on level roads, winding irregular grades, through the operation of the small finger lever which calls forth all the power of the engine for an instant or as long as is necessary.

It Performs Surprisingly

The car may be held on a grade by its engine power, the clutch generator slipping and holding with the aid of the electric motor ready to at once go forward upon opening the throttle. By closing the throttle slightly the car will move backward slowly and then at the will of the driver be stopped—then sent forward up to the maximum speed the grade will allow and all without disconnecting the power of the engine from the driving shaft.

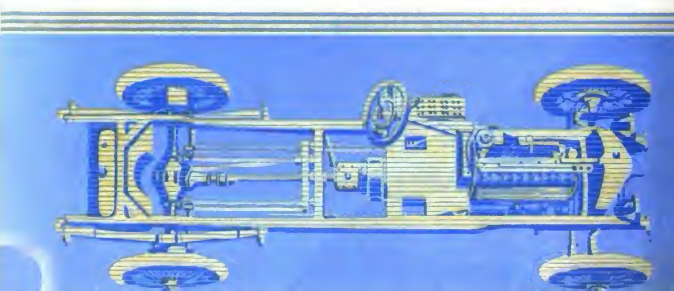
Owen Magnetic Builders

The electric apparatus in the Owen Magnetic car is built by the General Electric Company, which concern has acquired a large interest in the patents covering this transmission. The combination of the General Electric Co. with The Baker R & L Company, manufacturers of chassis and body, whose history in building fine coaches for over sixty years is synonymous with quality, guarantees to the owner a product of the highest possible quality.

BAKER R & L COMPANY CLEVELAND, OHIO

Manufacturers of OWEN MAGNETIC MOTOR CARS

Salesrooms: New York Boston Philadelphia Chicago San Francisco



In the [illegible]
Transmission [illegible]
use an [illegible]
magnetic [illegible]
which [illegible]
solutely [illegible]
from the [illegible]
wheel

BOURNE

TRUCKS

"The Most Advanced Truck in America"

A TRUCK that's revolutionary in its method of power transmission, in its ease of driving and its economy of operation is here. It is the Bourne Magnetic Truck.

The Bourne is the first and only truck to discard the conventional transmission and adopt the revolutionary but far more effective Magnetic Transmission.

It is a truck that is perfectly controlled by electricity, one whose speed can be changed instantly without jerk or jar, one that has continuous flowing motion, that is far easier to drive than the conventional type, that is much more economical to operate than others of its capacity, that has no clutch to slip or gears to grind, and that gives electric starting and lighting without a separate system.

All of this is made possible by the incorporation of the Magnetic Transmission into a truck that was designed and built to do a certain service BETTER than it was ever done before.

There is nothing theoretical about the Bourne superiority—we have the facts and figures to prove it. In seven months one truck has traveled 13,000 miles without the slightest trouble. It has used less gas, done more work, required less oil, been saving in tires and far easier to drive. In comparative tests, conducted by non-interested parties, the Bourne showed its leadership in every trucking essential.

Other important factors in getting these results were the specially designed truck motor, built expressly for truck service; worm-drive axles; Mather springs, longer than usual and having more deflection, also having very big spring clips, the springs riding on trunnions, a patented feature; frames of our own design and make; specially designed universal joints, long radius rods, etc.

This truck is now on the market. The producing company is strong financially, and deliveries can be made as required. Applications for agencies will be considered only from well-established, responsible dealers.

2-Ton $3150 **3½-Ton $3850**

Bourne Magnetic Truck Company

Sedgley Ave. at N. 17th St.
Philadelphia, Pa.

Save 20% of the cost of Cone Clutch Facings

How? By Specifying

Cone Clutch Facings

Fully Protected by Patents

LEATHERTEX Cone Clutch Facings cost, on an average, *20% less* than facings made of solid leather. Yet they are much *more* resilient, efficient and durable.

Here's just what every alert motorcar manufacturer is looking for—a cone clutch facing that gives *better* and *more satisfactory service* and at the same time helps materially to reduce *production costs.*

Try LEATHERTEX on the cars *you* are manufacturing. See what a remarkable facing it really is! Save 20%! Send cone today (at our expense) and let us make up a LEATHERTEX Facing for your tests gratis.

LEATHERTEX, as the name implies, is a combination of specially tanned leather and textile, the two being actually merged into one.

HIDE, LEATHER & BELTING CO.
227-B South Meridian Street INDIANAPOLIS, IND.
Detroit Office: 406 Kerr Building W. C. DuCOMB, Jr., Special Representative

PAIGE

The Standard of Value and Quality

We predict that the Paige exhibit at the New York automobile show will prove *unusually* interesting to motor car owners and prospective motor car purchasers.

Why?

Come around and discover the reason for yourself—And be prepared for a surprise.

Paige-Detroit Motor Car Company
Detroit, Michigan

Here is the "JASCO" TANK Installed.

AUTOCARS
USE THE
"JASCO" TANK

The Autocar Company, one of the most progressive of high-grade commercial car manufacturers, with a quality reputation of long standing, uses "JASCO" TANKS on its cars. The judgment used in design, manufacture and in the selection of material and parts has kept the Autocar in the front rank.

"JASCO" TANKS were not selected by good luck or chance, but because of their merit, after the most thorough experiments and careful investigation.

"JASCO" TANKS cost more—because they are better—much better than the riveted tank which *might* spring a leak at any time—with disastrous results, or dribble away in gasoline many times its cost through its leaky life.

It is by careful attention to details of this kind—details you cannot see at first glance—that certain automobiles secure and hold the high place that belongs to the quality product.

If the car you intend buying carries a "JASCO" TANK as standard equipment, you may be sure that the maker of that car has given very careful attention to details; that good material and mechanical perfection have not been skimped to make or meet a price.

The "JASCO" is a drawn steel, seamless, gasoline tank, tinned and tested, that positively cannot leak.

The "Jasco" Tank is used and endorsed by the following prominent manufacturers:

PLEASURE CARS

Biddle Motor Car Company, Simplex Automobile Company, Mercer Automobile Company, Lozier Motor Company, Stanley Motor Carriage Company, James Cunningham Son & Company, H. H. Franklin Manufacturing Company.

TRUCKS

Baldwin Locomotive Works, Autocar Company, General Vehicle Company, H. G. Burford Company, Peerless Motor Car Company, Garford Motor Truck Company, Gramm Motor Truck Company, Thomas Auto Truck Company, Motor Trucks, Ltd., Canada.

MOTOR BOATS AND NAVAL ARCHITECTS

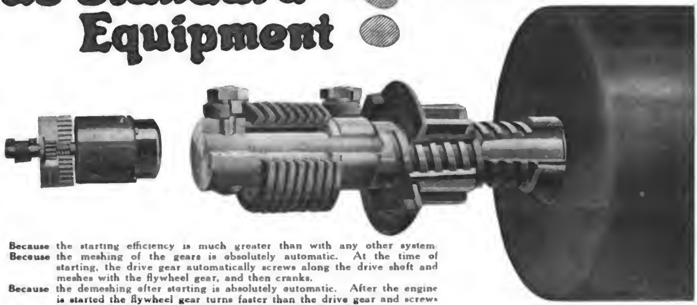
William H. Hand, Jr., Mathis Yacht Building Company, Gas Engine & Power Company.

JANNEY, STEINMETZ & CO.

Main Office: PHILADELPHIA

New York Office: Hudson Terminal Building

Why have 125 Car Builders adopted the ECLIPSE-BENDIX DRIVE as Standard Equipment?



Because the starting efficiency is much greater than with any other system.
Because the meshing of the gears is absolutely automatic. At the time of starting, the drive gear automatically screws along the drive shaft and meshes with the flywheel gear, and then cranks.
Because the demeshing after starting is absolutely automatic. After the engine is started the flywheel gear turns faster than the drive gear and screws the latter back on the drive shaft until it is out of mesh.
Because cast iron teeth without any chamfer not only make a great saving in cost, but are actually superior, being the simplest, most efficient and durable construction possible. The teeth are cut in the flywheel, which is a natural gear blank. Stripping of these teeth by accidental starting when the engine is running is impossible, because of the automatic demeshing action.
Because back-fires are automatically protected by the shock absorbing spring drive.
Because there is no over-running clutch to stick or slip.
Because there is no resistance or two-point switch to burn out.
Because there are no shifting levers and pedals, with their complications.
Because it is simpler and has fewer parts than any other starting system.
Because it eliminates chains, which stretch, break and get noisy.
Because it minimizes gear noise in cranking by driving through a spring.
Because it is absolutely silent when the engine is running, being absolutely disconnected.
Because it permits of using a simple, small generator for constant running.
Because it permits of cranking the engine with the most efficient of all starters—a separate electric starting motor—and also more evenly.
Because it makes the two-unit type of starting and lighting system superior to any other and the most popular of all.
Because it requires the minimum of care and attention during the life of car.
Because it is regularly supplied and used as standard equipment with the following starting and lighting systems, on over 125 different makes of motor cars, and also on a large number of marine and aeroplane motors:

A-B-C
Allis-Chalmers
Auto-Lite
Delco
Detroit
Disco
Dyneto
Gray & Davis
John O. Heinze
Kemco
Leece-Neville
North East
North Western
Remy
Robbins & Myers
Roth Bros.
Splitdorf
Wagner
Ward-Leonard
Westinghouse

Eclipse Machine Company, Elmira, N. Y.

New York Show Headquarters - - - - - - The Biltmore Hotel

Sales Agents: Brandenburg & Company

New York: 57th St. and Broadway Detroit: Dime Bank Bldg. Chicago: 1112 Michigan Ave.

The following makes of cars are using the Eclipse-Bendix Drive as regular equipment:

Abbott-Detroit
Allen
All Steel
Alter
American
Ames
Anderson
Apperson
Auburn
Austin
Barley
Biddle
Bimel
Bour-Davis
Briscoe
Canadian-Regal
Case
Chalmers
Chandler
Chevrolet
Cole
Columbia
Commonwealth
Crawford
Crow-Elkhart
Cummings
Daniels
Davis
Denmo
Detroiter
Dixie
Dorris
Dort
Drummond
Duplex
Elcar
Elgin Six
Emerson
Empire
Enger
Erie
Federal
Fostoria
Geneva
Gerlinger
Glide
Ghent
G. M. Truck
Gramm-Bernstein
Grant
Gray-Dort
G. V. Truck
Hal
Halladay
Harroun
Haynes
Henney
Imperial
International
Interstate
Jackson
Jordan
Kelly-Springfield
King
Kissel
Kline
Lenox
Lescina
Lexington
Liberty
Lippert-Stewart
Little Giant
Lozier Bros.
Madison
Marion-Handley
McFarlan
Meteor
M. H. C.
Mitchell
Moline-Knight
Moline Plow
Monarch
Monitor
Monroe
Moon
Murray
Mutual
Napoleon
National
Nelson LeMoon
Northway
Nuero
Oakland
Ogren
Oldsmobile
Overland
Owen Schoeneck
Paige
Partin Palmer
Paterson
Pathfinder
Peerless
Pennsy
Pierce Arrow
Pilliod
Pilot
Premier
Primus
Pullman
Regal
Remington
Republic
Roamer
Rockhill
Ross
Russell
Saxon
Scripps-Booth
Service
S. G. V.
Singer
South Bend
S & S
Stearns
States
Standard
Stegeman
Stephens
Sterling
Stewart
Sun
Thomas
Touraine
Trumbull
Union
U. S.
Velie
Vulcan
Wealthy-Heights
Westcott
Willys-Knight
Winton
Wolverine

Electric Auto-Lite

STARTING – LIGHTING – IGNITION

A System and a Service That Are Unapproached

¶ The Electric Auto-Lite Starting, Lighting and Ignition System is used on more cars, by far, than any other system made.

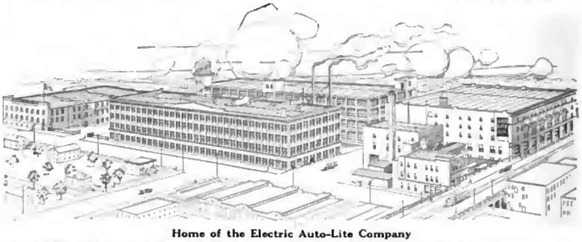
¶ Extreme lightness, compactness and tremendous power, coupled with sturdy construction and downright dependability, make the Auto-Lite System worthy of the commanding position which it holds—a position gained purely through merit.

¶ And though seldom called upon, the service behind this extraordinary system is in every way up to the standard of the system itself.

The Electric Auto-Lite Co.

Head Office and Factory
Toledo - - - - Ohio

Detroit Sales Office
1507 Kresge Bldg.



Home of the Electric Auto-Lite Company

These buildings, of the most modern construction, contain approximately 422,000 square feet of floor space. They are equipped with the most approved modern machinery and are turning out 1400 complete starting and lighting systems every day.

What would have prevented most of the auto-mishaps you know of?

Wouldn't good brake lining have done it?

Careful drivers know or they are fast learning the false economy of friction-shy brake lining.

They are learning the advantage of Thermoid 100% brake lining—an advantage that may any time mean the difference between a close shave and a crumpled car—a narrow miss or a crushed body.

Thermoid
HYDRAULIC COMPRESSED
Brake Lining - 100%

Brake lining that is not 100% is like a heart failure. A sudden shock—a Big Emergency—may mean death.

Thermoid Brake Lining has 100% gripping and holding power even when it is worn paper thin.

That means that, lined with Thermoid, brakes will hold, not only when the car is just being stopped but when it must stop quick or hit something.

Thermoid wears because it is cured under hydraulic compression into a solid substance of uniform density. It contains 50% more material foot for foot than do other kinds. Watch the brakes—remember that without a lining they are not brakes at all. Consider, too, how much better it is to see they are lined with Thermoid Brake Lining than to have a finely equipped motor crumpled into junk in an instant, or to have to race to a hospital with a child or adult that would not have been hit if the brakes had held.

Thermoid Brake Lining is absolutely guaranteed to give more satisfactory results and to outwear any other lining manufactured. Not affected by heat, oil, water, gasoline or dirt

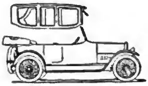
OUR GUARANTEE:
Thermoid will make good or we will

Thermoid Rubber Company
Trenton, N. J.

KISSELKAR
EVERY INCH A CAR

The ALL-YEAR Car

Kissel's Original Idea That Changed the Motoring Habits of a Nation



The Hundred Point Six

The car of a Hundred Quality Features. Its mighty Kissel-built engine will meet any demand for speed on the straightaway, power on the incline, flexibility in traffic zones.

Hundred Point Six
ALL-YEAR Models

Mounted on Gibraltar Body

Touring-Sedan	$1635
Roadster-Coupe	$1635
Victoria-Town Car . . .	$1950

Hundred Point Six **without ALL-YEAR Feature $1195**

Hundred Point Six **with Gibraltar Body . . . $1245**

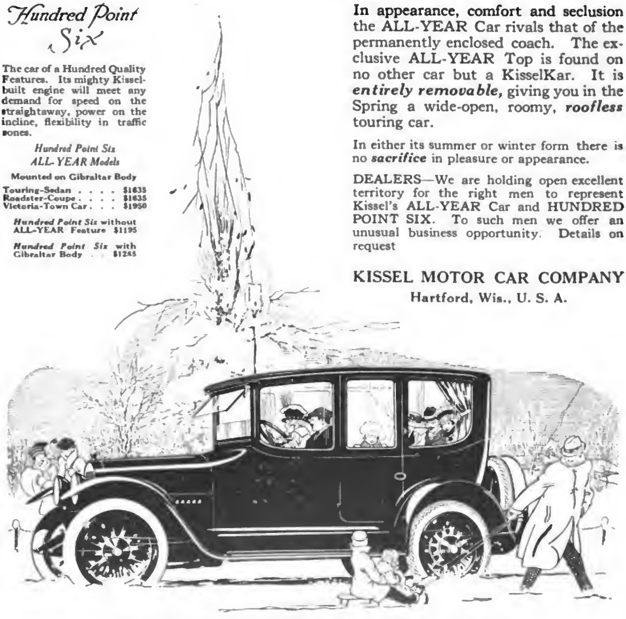
NO matter how severe the weather, your ALL-YEAR Sedan is built so ***close-fitting*** that it is absolutely weatherproof. The ALL-YEAR Top ***fits in***—not on—rain cannot leak in, snow cannot drift in, wind cannot blow in—every part is ***draft-proof*** and ***rattle-proof***. ***Nothing*** can work loose.

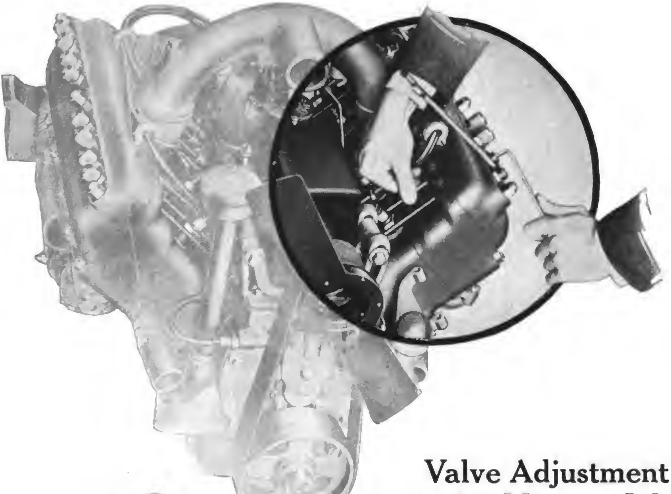
In appearance, comfort and seclusion the ALL-YEAR Car rivals that of the permanently enclosed coach. The exclusive ALL-YEAR Top is found on no other car but a KisselKar. It is ***entirely removable,*** giving you in the Spring a wide-open, roomy, ***roofless*** touring car.

In either its summer or winter form there is no ***sacrifice*** in pleasure or appearance.

DEALERS—We are holding open excellent territory for the right men to represent Kissel's ALL-YEAR Car and HUNDRED POINT SIX. To such men we offer an unusual business opportunity. Details on request

KISSEL MOTOR CAR COMPANY
Hartford, Wis., U. S. A.





Valve Adjustment a 10-Minute Job

In Ferro V-Type Motors, the valve adjusting screws are on the top of the cylinder-head cover, right within easy reach.

All that is required for taking up valve clearance is to unscrew a cap, loosen a locknut and turn the adjusting screw.

The car-owner himself can adjust all the valves in ten or fifteen minutes.

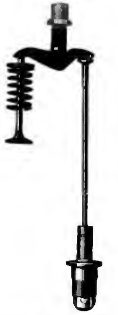
This big improvement was made possible by placing the valves in the head and using detachable heads without valve cages.

It is but one of a number of features that make Ferro V-Type Motors so desirable.

Write for booklet

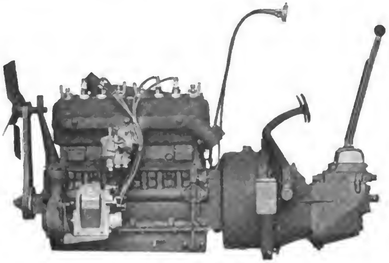
THE FERRO MACHINE & FOUNDRY CO.
1293-S Hubbard Avenue Cleveland, Ohio

FERRO MOTORS
Reg U S Pat Off



Assembling of valve reciprocating parts. Note adjusting screw and spherical fulcrum at top, roller valve-lifter at bottom.

The 1917 Model—Ready Now



ONE MODEL—ONE SIZE

Four Cylinders 3¾ x 4¼ in. 22½ H. P. (A. L. A. M.)
36.9 H. P. at 2800 r. p. m. Three Bearings

G B & S motor

This is the same G. B. & S. motor on which we have concentrated for several years, but it has been refined, and refined again, until we verily believe it is as nearly perfect as it is possible to build any motor.

Refinements for 1917 include four definite improvements.

Shorter intake—permitting placing of carburetor closer to motor, thereby reducing gas friction and increasing motor efficiency.

New chain adjustment which permits taking up all slack and keeping the motor noiseless. Chains may be adjusted quickly while motor is running. Send for details of this feature.

Now using ½-in. pitch chain with master connecting pin instead of ⅜ in. as heretofore.

Larger flywheel, which gives greater starting torque and makes the G. B. & S. motor singularly free from vibration.

Larger flywheel housing provides ample room for placing of an "in-board" starter—

These are all refinements of detail. We could not improve the G. B. & S. Four from the standpoint of power, quality, economy, long life, flexibility and service. But by concentrating on this one size and one type of motor we have brought it to a high pitch of excellence.

If you are interested in one of the most dependable, reliable, smooth-running "fours" ever built, write

Golden, Belknap & Swartz Company

DETROIT, MICHIGAN

EISEMANN

MAGNETOS

The intensely hot spark and full-throated explosions at all speeds—even the lowest—prove clearly the superiority of the Eisemann Magneto.

It means easy starting, quick pick-up, sure fire of any mixture, richest to leanest.

And durable—no magneto is made simpler or stronger.

THE EISEMANN MAGNETO CO.

Sales and General Offices:
32-33rd St., Brooklyn, N. Y.
Detroit, Mich., 802 Woodward Ave.

This Is the Plug

These Are the Manufacturers Who Equip With AC

The Standard Spark Plug of America

Packard
Pierce-Arrow
Cadillac
Marmon
Hudson
Chalmers
Hupmobile
Chandler
Haynes
Chevrolet
Dort
Cole
Reo
Paige
Peerless
Dodge Brothers
Buick
Oakland
Oldsmobile
Jeffery
Stearns-Knight
Saxon
Stutz
National
Velie
Jackson
Apperson
Davis
Detroiter
Paterson
McFarlan
Sandow Truck
Pathfinder
Scripps-Booth
Westcott
Signal Trucks
Lexington-Howard
Brockway Truck
Chase Truck
Daniels
Federal
G. M. C.
Gramm-Bernstein Trucks
Kissel Kar
Murray
Bour-Davis
Premier
Republic Truck
Knox
McLaughlin (Canada)
Monroe
Netco Trucks
Moreland Trucks
Pilot
Crane-Simplex
Singer
Stephens
United Truck
Wilcox Truck
Jordan
Liberty
Sterling Truck

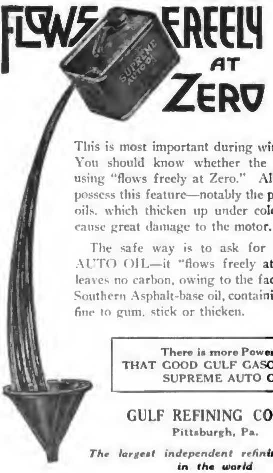
No Greater Recommendation Can Be Given a Spark Plug

Have You This Plug On Your Car?

Accept No Plug Unless AC is Burnt Into the Porcelain

Sold Everywhere

Champion Ignition Co. Flint, Mich.



FLOWS FREELY AT ZERO

This is most important during winter months. You should know whether the oil you are using "flows freely at Zero." All oils do not possess this feature—notably the paraffine base oils, which thicken up under cold, and often cause great damage to the motor.

The safe way is to ask for SUPREME AUTO OIL—it "flows freely at Zero," and leaves no carbon, owing to the fact that it is a Southern Asphalt-base oil, containing no paraffine to gum, stick or thicken.

There is more Power in THAT GOOD GULF GASOLINE and SUPREME AUTO OIL

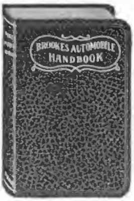
GULF REFINING COMPANY
Pittsburgh, Pa.

The largest independent refining company in the world

The Most Practical Book on the Automobile Ever Published

BROOKES' Automobile Handbook

(NEW EDITION)



For the owner, repairman, garages, automobile designers and dealers. A complete encyclopedia including every subject in relation to the automobile.

An idea of the extent of some of the main divisions may be formed from an inspection of Starting and Lighting (91 pages), Carburetor Instructions (52 pages), Transmission Systems (38 pages), Ignition (126 pages), and Engines (46 pages).

715 pages. 335 illustrations and 12 tables. Printed on plate paper.

Handsomely bound in leather, stamped in gold, red edges, round corners, pocket size

Price, postpaid, $2.00

FREDERICK J. DRAKE & CO.
1005 Michigan Ave. Chicago, Ill.

Limousine Luxury With Your Present Open Car

Blackmore Door Curtain Openers give you all the advantages of a car enclosed in wood or glass. When curtains are attached, they enable you to open your doors all the way up. No buttons to fuss with, no curtains to bother you. No "ducking" or stooping to enter or leave the car These patented Blackmore Openers are simple inexpensive steel supports for automobile door curtains. They enable the open body to offer every advantage of the closed limousine. Once you have attached them you can forget all about your curtains until spring. The openers can be instantly detached and put away with your curtains

The Old Way

- BLACKMORE -
DOOR CURTAIN OPENERS

DON'T PUT UP YOUR CAR THIS WINTER
TAKE IT TO YOUR NEAREST TOP MAKER

and have Blackmore Openers attached in an hour's time

Standard Equipment on 1917 Models

Packard	Reo	Jackson
Cadillac	White	Locomobile
Studebaker	Franklin	Chalmers

With the Blackmore Door Curtain Openers

DAYTON TOP IMPROVEMENT COMPANY, DAYTON, OHIO

PATENT NOTICE: We control basic patents on door curtain openers, and will vigorously prosecute any infringers

---

PITTSFIELD DISTRIBUTOR

SIMPLE ABSOLUTELY

DURABLE FOOL-PROOF

An open circuit and a breaker mechanism independent of springs.

Look at these three illustrations. The two small platinum points are forced together and then forced apart by the revolving cam. The cam is so shaped that while the "make" or contact is firm it is of much shorter duration than the "break" action, thus leaving an open circuit most of the time. This means ECONOMY.

Notice particularly that the cam action not only drops the lower contact point, but pushes up the contact point, to break the contact; also that it lifts the lower and drops the upper to make contact. This means POSITIVE UNFAILING ACTION—MECHANICAL ACTION.

The cam action in Fig. 1 is designed for a 4-cylinder engine; the cam action in Fig. 2 is designed for a 6-cylinder engine; the cam action in Fig. 3 for an 8-cylinder engine. Count the camal

Electrical and mechanical lags are practically eliminated by this simple, positive action, and timing synchronization made as nearly perfect as is humanly attainable.

The whole ignition outfit is simple, compact, and made into a single unit, including the coil.

Write for complete details

Pittsfield Spark Coil Company
Pittsfield, Massachusetts

Fig. 1

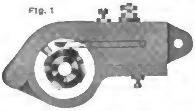


Fig. 2

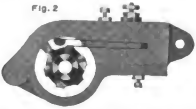
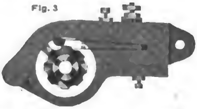


Fig. 3



SIMMS MAGNETO
SIMMS-HUFF
ELECTRIC STARTING & LIGHTING

"No trouble whatever, and we find splendid service from the Simms."
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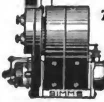

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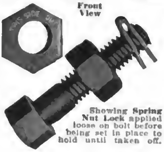
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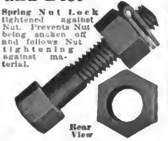
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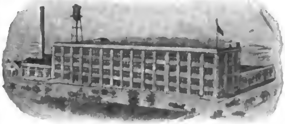

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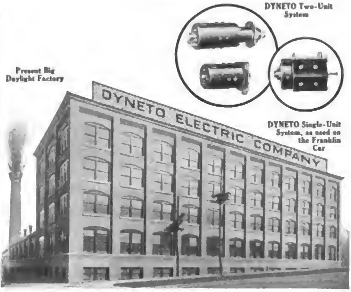

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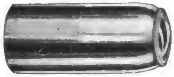

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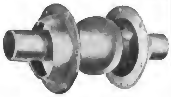

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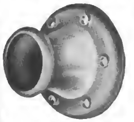

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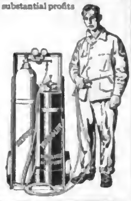

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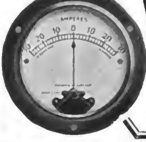

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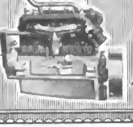

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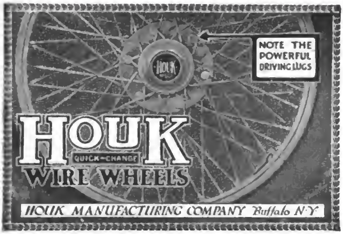

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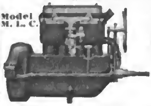

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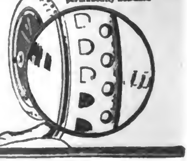

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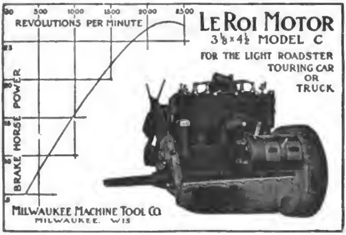

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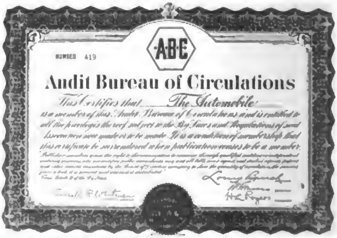

A·B·C

NUMBER 419

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that will in no way be original but nevertheless worth money to you, will be to resolve what hundreds of others are sure to do—always do—and that is; continue for another year to come to headquarters for service that puts money to your name in the book.

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RADIATORS—V-shaped for Ford, Honeycomb, Brass, $23.50; German Silver, $24.50; Abbott Detroit, all models, $30.00; Studebaker, "25," $22.50; 6 cylinder, 1914, $25.00; Paige Model 25, $22.50; Oakland, many models, each, $22.50; Benham, $30.00; King Model E, 1916, $30.00; Everitt 30, $22.50; Crescent 4 and 6 cylinder, $30.00.

RIMS—Stanweld S. S. 36 x 4½, $5.00; 34 x 4½, $1.50; 32 x 3½, $2.50; Firestone Q. D. Clincher 36 x 4½, $2.40; 36 x 4, $2.30; 34 x 4 Universal, $2.30; Baker 36 x 4 and 34 x 4 S. S., each, $2.60; 32 x 3½ S. S., $2.55; Booth Clincher 36 x 4½, $4.00; 36 x 4 and 32 x 4, $2.30; Detroit 34 x 4 Clincher, 36 x 4 S. S. and 1912 S. S., each, $2.70; 32 x 3½ Clincher, 1912 S. S. and 30 x 3½ 1912 S. S., each, $2.40; Kelsey 32 x 3½ No. 20 Clincher and No. 30 S. S., each, $2.30; 34 x 4 No. 30 Clincher, $3.60.

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Buick D	30.50	Mitchell F	32.50
Buick F	30.50	Michigan 40	35.00
Buick F 1916	30.50	Overland 69	31.50
Buick 36 C	36.80	Overland 52	31.50
Chalmers 40	32.00	Overland 38	31.50
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Cole 40	36.25	Oakland 10-40	31.50
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We have in stock, ready to meet your wants, Pistons, Axles, Cylinders, Magnetos, Motors, Lamps and everything in the auto line at

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We sell only parts that are serviceable and if our parts are unsatisfactory, we will cheerfully refund your money.

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115 Grand River Ave., Detroit, Mich

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At the commencement of sale, we will offer the good will and service of the **Milwaukee Motor**, consisting of Service parts, jigs and dies, blue prints, names of car manufacturers who have used Milwaukee motors in their cars and list of car owners. Approximately 20,000 Milwaukee motors were manufactured and sold.

We will next offer Service of the **Cutting** and **Clark-Carter** cars, of which approximately 5,000 cars were manufactured. Also repair parts for Mason cars. The service of all the above is now being conducted and kept intact. Each service will be sold separately. The services are doing a prosperous and profitable business.

Immediately after sale of Service Departments, we will sell the following items:

150 Milwaukee unit plant motors complete with transmissions and clutches.
40 assembled one ton truck chassis.
15 one ton trucks complete with bodies.
35 roadsters and touring car chassis.
All of the above chassis are equipped with Milwaukee motors.
200 touring car, roadster and truck bodies, upholstered and in white.
400 sets Lewis springs, 100 sets Timken, Hess and Lewis front and rear axles, Warner transmissions, 500 truck and touring car frames, aluminum crank and transmission cases, 250 Warner and Lavigne steering gears.
300 sets 34 x 4, 36 x 4, 36 x 4½ wheels with Firestone, Stanwell and Baker demountable rims.
Lathes, drill presses, milling machinery machines, large stock of tools, turret lathes.

Commencing Thursday, January 4th, at 10 A. M.
Supplies and Parts

An enormous quantity of standard brands and staple parts, consisting of leather, leatherette, linings, mohair, seat cover material, duck, etc. Sheet celluloid, wire, cable and conduit, bows, one man top sets, curled hair, American and Berry body and coach varnishes, finishes, paints and enamels, Bosch, Remy, Splitdorf, New Departure and F. & S. bearings, Remy coils, piston rings, motor parts, magnetos, carburetors, mufflers, 100 Northeast, Jesco and Apple starters, spot lights, crank cases, gauges, electric starters, batteries, pumps, draw shafts, gears, ball bearings, hoods, fenders, crank shafts, clutches, grease cups, axles, springs, transmissions, steering wheels, frames, levers, tool sets, springs, leaves, spark plugs, speedometers, cocks, tool boxes, spark coils, control levers, sprockets, chains, brass tubing, pipe, gear shifts, crank shafts, valves, switches, 100 Rain-vision windshields, 150 radiators, 500 motor horns, trucks, oval gas tanks, gasoline tanks, tires, die cast bearings, etc.

Also an enormous quantity of brass, aluminum and copper castings, parts, and supplies, nuts and bolts, screws, washers, rubber goods, etc. A very large quantity of machine and rough castings, motor castings, brass and copper scrap, junk, oils, greases, supplies, etc. Also a large quantity of tool steel, shaftings, pulleys, hangers, trucks, steel tanks, enameling ovens, cranes, scales, fire extinguishers, cushions, etc., in fact, parts and supplies of every description.

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Terms of sale strictly cash. Positively no checks will be accepted unless certified. All goods sold to be removed at the risk and expense of purchaser. All merchandise not removed at time specified by auctioneers will be re-sold and deposit of purchaser will be forfeited without further notice.

Please Note.

Nothing will be sold at private sale at any time prior to date of auction sale set. Everything will positively be sold at this sale without any reserve or restriction. Sale will be held at Waterloo, Iowa, on Wednesday, January 3d, and Thursday, January 4th, 1917. Excellent loading facilities. Trackage and shipping platform adjoining building.

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34x3½	5.50	1.60	36x4½	8.25	1.85
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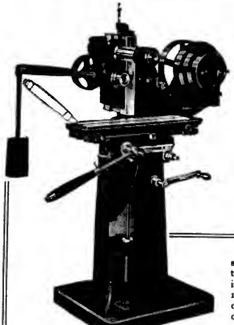

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Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

American Ball Bearing Co.... 87
American Bronze Company.... 50
American Motors Co....57 to 60
American Sheet & Tin Plate Co.... 90
Atwater Kent Manufacturing Works.... 87
Automobile Engineer 84

B

Baker R & L Co....65 and 68
Bearing Co. of America.... 91
Beaver Mfg. Co.... 88
Bock Bearing Co.... 61
Bosch Magneto Co.... 91
Bossert Co..... 85
Bourne Magnetic Truck Co.... 69
Braender Rubber & Tire Co.... 87
Brown-Lipe-Chapin Co. 89

C

Celfor Tool Company.... 89
Central Steel Company....100
Champion Ignition Co.... 80
Cincinnati Storage Battery Co.... 87
Columbia Axle Co.... 52
Columbia Graphophone Co.... 90
Columbus Varnish Co., The.... 98
Continental Motor Co.... 91
Corcoran-Victor Co. 86
Cullman Wheel Co.... 90

D

Dayton Top Improvement Co.... 81
Detroit Accessories Corp.... 63
Drake & Co., F. J.... 80
Dyneto Electric Co.... 83

E

Eclipse Machine Co.... 73
Edmunds & Jones Corp.... 91
Eisemann Magneto Company.... 79
Electric Auto-Lite Co.... 74
Electro Metal Products Co.... 88

F

Fahrig Metal Co.... 88
Ferro Machine & Foundry Co.... 77
Firestone Tire & Rubber Co.... 91

G

Gibson-Hollister Mfg. Co.... 88
Golden, Belknap & Swartz Co.... 78
Grossman Corp., Emil.... 84
Gulf Refining Company.... 80

H

Hartford, E. V., Inc.... 1
Hawthorne Mfg. Co., Inc.... 90
Hess-Bright Mfg. Co.... 62
Hide Leather & Belting Co.... 70
Horton Mfg. Co., F. L.... 99
Houk Mfg. Co.... 88
Hudson Motor Car Co....Front Cover
Hyatt Roller Bearing Co.... 89
Hydraulic Pressed Steel Co.... 84

I

Indiana Rubber & Insulated Wire Co.... 86

J

Janney-Steinmetz & Co.... 72
Jepson, John W.... 90
Johns-Manville Co., H. W.... 87
Johnson & Sons, S. C.... 51

Index to Advertisers

K

K-W Ignition Co. 83
Kissel Motor Car Co. 76

L

Liberty Cut Glass Works 85
Liberty Motor Car Co. 89

M

Mercer Automobile Co. 49
Merrill Spring Co., E. R. 90
Milwaukee Machine Tool Co. 90
Moltrup Steel Products Co. 87
Motor Age 86
Mutty Co., L. J. 64

N

National Auto Show 56
National Rubber Co. 86
New Departure Mfg. Co. 89
New Process Gear Corporation 91
N. J. Car Spring & Rubber Co. 88
N. Y. & N. J. Lubricant Co. 86

O

Oakley Chemical Co. 85

P

Paige-Detroit Motor Car Co. 71
Park Drop Forge Co. 90
Perlman Rim Corp. 88
Pfau Mfg. Co. 83
Pittsfield Spark Coil Co. 81
Prest-O-Lite Co. 86

R

Rajah Auto Supply Co. 89
R. & H. Platinum Works 87

S

Salisbury Wheel & Mfg. Co. 91
Seidel, Carlos M. 2
Sheldon Axle & Spring Co. 86
Simms Magneto Co. 82
Splitdorf Electrical Co. 82
Spring Nut Lock Company 82
Star Rubber Co. 53
Stewart-Warner Corp. 2nd Cover
Stromberg Motor Devices Co. 88
Studebaker Corp. 4
Sunderman Corporation 84

T

Thermoid Rubber Co. 75

U

United Smelting & Aluminum Co. 99

W

Ward Leonard Electric Co. 89
Waukesha Motor Co. 87
Weston Electrical Instrument Co. 86
Whitney Mfg. Co. 98
Willys-Overland Co. Back Cover
Winkley Co. 89
Wyman & Gordon Co. 3

Z

Zenith Carburetor Co. 3rd Cover

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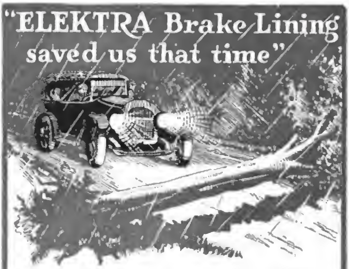
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